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COTTAGERS' SELF HELP PROGRAM

ENRICHMENT STATUS OF LAKES IN THE SOUTHEASTERN REGION OF ONTARIO 1985

Ministry of the Environment
Ontario

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Southeastern Region

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SOUTHEASTERN REGION OF ONTARIO

1985

Water Resources Assessment Unit

Technical Support Section

Southeastern Region

Ministry of the Environment

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ACKNOWLEDGEMENTS

The Ministry of Environment gratefully acknowledges those who contributed time and effort to make the 1985 Self Help Program a success.

A special appreciation is due to those volunteers and Associations that have ensured a continuity of participation in the program over the years.

The following Associations have previously earned special recognition in appreciation of a record of participation of 10 or more years.

Battersea-Loughborough Association
White Lake Water Quality Committee
Otty Lake Association
Baptiste Lake Association
Crowe Lake Property Owners Association
West Devil Lake Property Owners Association
Salmon Trout Cottagers Association
Limerick Waterways Ratepayers Association
Mink Lake Betterment Association
Glanmire Lake Cottagers Association

This year special recognition is extended to the Associations listed below. With their participation in 1985, they have now been involved in the program for a minimum of ten years:

Buck Lake Protective Association
North Shore Grippen Lake Cottage Association
Pike Lake Property Owners Association
Dr. A.W. Kahn (Otter Lake)
Mr. R.F. Sanderson (Hay Bay)
Bon Echo Provincial Park
Charleston Lake Provincial Park
Sharbot Lake Provincial Park

The concerted efforts of the various members of these Associations and other individuals have been especially valuable in assisting with data collection which expands our understanding of the natural variation in the water quality of lakes from year to year. This understanding is essential to determine whether shoreline development and other activities around lakes are having any effect on their water quality and to help guide the lake management decision making process.

REMERCIEMENTS

Le ministère de l'Environnement désire exprimer sa reconnaissance à tous ceux qui, grâce au temps et à l'énergie qu'ils y ont consacrés, ont contribué à la réussite du programme Entraide en 1985.

Nous adressons des remerciements particuliers aux bénévoles et associations qui participent sans relâche au programme depuis plusieurs années.

Les accomplissements des associations suivantes, qui prennent part à ce programme depuis 10 ans ou plus, ont déjà été soulignés de façon spéciale :

Battersea-Loughborough Association
White Lake Water Quality Committee
Otty Lake Association
Baptiste Lake Association
Crowe Lake Property Owners Association
West Devil Lake Property Owners Association
Salmon Trout Cottagers Association
Limerick Waterways Ratepayers Association
Mink Lake Betterment Association
Glanmire Lake Cottagers Association

Cette année, nous étendons nos remerciements aux associations ci-dessous pour qui 1985 marque au moins la dixième année de participation au programme :

Buck Lake Protective Association
North Shore Grippen Lake Cottage Association
Pike Lake Property Owners Association
Docteur A.W. Kahn (Otter Lake)
M. R.F. Sanderson (Hay Bay)
Bon Echo Provincial Park
Charleston Lake Provincial Park
Sharbot Lake Provincial Park

Grâce à leurs efforts conjugués, les divers membres de ces associations et d'autres particuliers ont contribué à la cueillette de données qui nous permettent de mieux comprendre les variations naturelles de la qualité de l'eau des lacs d'une année à l'autre. Il est essentiel d'avoir de telles connaissances si nous voulons être en mesure de déterminer si le développement riverain et d'autres activités effectuées en bordure des lacs ont des répercussions sur la qualité de l'eau, et d'aider à la prise de décisions relatives à la gestion des lacs.

ABSTRACT

Since 1971, the Southeastern Region of the Ministry of the Environment has enlisted the assistance of cottagers and other interested lakeside residents in a cooperative Self Help monitoring program. The program involves routine water sampling and water clarity measurements for the purpose of monitoring the amount of algae in a lake.

Between 1971 and 1985 the Program has involved close to 200 lakes in southeastern Ontario. Increasingly large numbers of lakes have now been involved in the Program for ten or more continuous years. The efforts of the Self Help program participants have given the Ministry a wealth of scientific data of immeasurable value. While this report deals primarily with the 1985 findings it is considered appropriate to highlight some of the many benefits of the program.

The coverage of lakes is extensive enough in terms of geographic distribution to provide a clear picture of the general status of water quality conditions of lakes throughout Southeastern Ontario. The picture which emerges is generally one of low biological productivity and excellent water quality conditions for all forms of recreational pursuits and passive enjoyment. Only a small proportion of the lakes in Southeastern Ontario have occasional algal densities high enough to interfere with their use and enjoyment.

Sound water quality management decisions for lakes require sound understanding of their water quality conditions. The Self Help program participants are playing a vital role in developing the understanding of lake water quality conditions.

The scientific data derived from the Self Help program now serves as a primary source of information for Ministry scientists, municipalities and consultants involved in either drafting or commenting on Official Plans, Zoning By-Laws and specific development proposals involving lakes in southeastern Ontario.

ABSTRACT (cont'd)

This report presents the sample results for 82 locations on 69 lakes sampled in the Southeastern Region of Ontario during 1985. The results are discussed in terms of seasonal and yearly variations in water quality.

Reported chlorophyll levels were higher for many of the lakes than they have been before; however, this is believed to be due largely to a change in the analytical procedure to improve recovery of chlorophyll from the samples submitted.

In general, most of the lakes had excellent water quality conditions. Only a few lakes experienced algal levels high enough to be objectionable or to limit water clarity for swimming and bathing use.

In addition to these general comments it is noteworthy that the trend of improvement in water quality of Muskrat Lake continued during 1985, and that the massive and troublesome algal bloom which disrupted the recreational usage of Stoco Lake during 1984 was not repeated in 1985.

The report contains a section entitled "Protection of the Lake". This section provides cottagers with information on practical ways to preserve and enhance water quality in their lakes.

RÉSUMÉ

Depuis 1971, la région du Sud-Est du ministère de l'Environnement s'est assuré la collaboration de propriétaires de chalets et d'autres riverains intéressés pour l'exécution d'un programme de surveillance fondé sur l'entraide. Dans le cadre de ce programme, des échantillons d'eau sont prélevés périodiquement et la turbidité de l'eau est mesurée pour surveiller la quantité d'algues dans les lacs.

De 1971 à 1985, de telles analyses ont été effectuées grâce à ce programme dans près de 200 lacs du Sud-Est de l'Ontario. Un nombre croissant de lacs font l'objet du programme, certains depuis dix années consécutives ou plus. Grâce aux efforts des participants au programme Entraide, le ministère a pu rassembler une somme considérable de données scientifiques inestimables. Même si le présent rapport porte essentiellement sur les conclusions de 1985, il nous apparaît pertinent de souligner quelques-uns des nombreux avantages que comporte ce programme.

La répartition géographique des lacs surveillés dans le cadre du programme est suffisamment étendue pour que l'on se fasse dans l'ensemble une bonne idée de la qualité de l'eau dans les lacs du Sud-Est de l'Ontario. Il ressort de l'analyse des données obtenues qu'en général l'activité biologique est faible et la qualité de l'eau excellente pour toutes les formes d'activités récréatives. Ce n'est que dans un pourcentage minime des lacs du Sud-Est ontarien que la quantité d'algues est occasionnellement élevée au point où l'on ne peut ni les utiliser ni en jouir.

RÉSUMÉ (suite)

Pour que des décisions judicieuses soient prises en ce qui a trait à la gestion de la qualité de l'eau des lacs, il faut bien comprendre les conditions qui influent sur la qualité de l'eau. Les participants au programme Entraide ont un rôle important à jouer pour mieux faire comprendre ces conditions.

Les données scientifiques obtenues grâce au programme Entraide constituent désormais une source fondamentale de renseignements pour les scientifiques du ministère, les municipalités et les experts-conseils qui prennent part soit à l'ébauche de plans officiels, de règlements de zonage et de propositions d'aménagement précises touchant les lacs du Sud-Est ontarien, soit à la formulation d'observations à leur sujet.

Le présent rapport fait état des conclusions de l'analyse d'échantillons prélevés à 82 emplacements dans 69 lacs du Sud-Est de l'Ontario en 1985. Les résultats sont examinés en fonction des variations saisonnières et annuelles influant sur la qualité de l'eau.

On a constaté que, dans plusieurs des lacs, les concentrations de chlorophylle étaient beaucoup plus élevées qu'auparavant. On estime cependant que cela résulte d'un changement apporté à la méthode d'analyse employée pour améliorer la récupération de la chlorophylle dans les échantillons.

Dans l'ensemble, la qualité de l'eau était excellente pour la majorité des lacs. Il n'y a que dans un petit nombre de lacs que les quantités d'algues étaient élevées au point d'être inacceptables ou de rendre l'eau trop trouble pour la natation ou la baignade.

RÉSUMÉ (suite)

Outre ces observations générales, il convient de signaler que la tendance qui s'était manifestée relativement à l'amélioration de la qualité de l'eau du lac Muskrat s'est maintenue en 1985, et que la croissance massive d'algues qui a empêché l'utilisation du lac Stoco à des fins récréatives en 1984 ne s'est pas reproduite en 1985.

Dans la section du rapport intitulée "Protection of the Lake", les proriétaires de chalets trouveront des renseignements sur les moyens pratiques de maintenir et accroître la qualité de l'eau des lacs.

1.0 INTRODUCTION

Ontario has some 250,000 inland lakes and borders four of the five Great Lakes. Increasing amounts of leisure time, growing affluence, and the easy accessibility of lakes to urban centers of population have resulted in the extensive development of lakes with summer cottages and waterfront resorts and campgrounds.

Increased development and activity within the watershed of a lake can result in changes to the lake itself. The most common of these changes is an increase in the rate of supply of nutrients to the lake. The result of an increase in the nutrient supply, especially phosphorus, may be an increase in the growth and abundance of aquatic plants and algae in the lake. Algae are microscopic green plants which, along with other aquatic plants, convert the radiant energy of sunlight to the chemical energy of plant tissue. This phenomenon is termed primary production. Increased primary productivity gives rise to increased production of organisms at all levels of the food chain up to and including fish. The process of increasing nutrient enrichment and biological productivity of a lake is scientifically referred to as eutrophication.

All lakes require nutrients for the production of plant life. Aquatic plants and algae provide food and shelter for fish. Up to a point eutrophication resulting from nutrient enrichment may improve fishing but serious eutrophication can cause oxygen depletion to the point of making it impossible for certain species of fish to survive in a lake.

Increased amounts of algae cause water to become progressively more turbid with a corresponding reduction in water clarity. Weed beds interfere with nearshore aquatic activities such as swimming and boating. Increased amounts of algae may also increase water treatment costs where such lakes are used as a source of domestic water supply.

In 1970, in response to the concerns of cottagers that shoreline development was causing a deterioration of water quality in recreational lakes, the MOE initiated a comprehensive recreational lakes water quality survey program. The program provides an inventory of the water quality conditions of our recreational lakes involving physical, chemical and biological evaluations with emphasis on defining their state of nutrient enrichment. To date, the program has involved detailed studies of approximately 300 lakes in Southeastern Ontario.

With the recreational lakes water quality survey program in place to provide the initial evaluation of a lake's water quality, the value of a long term water quality monitoring program became evident. Such a program was, however, beyond the capability of the Ministry without assistance. For this reason, in 1971 the MOE enlisted the voluntary assistance of cottagers, cottage associations, and others to make regular water clarity readings at their lakes, and to collect water samples, hence the name Self Help Program. The program commenced on 12 lakes across the province and by 1985 included 69 lakes in the Southeast Region alone (Table 1).

The Southeastern Region includes Hastings, Prince Edward, and Renfrew Counties and extends eastward to the Ontario/Quebec border. It encompasses an area of 35,523 square kilometres and contains a population of 1.2 million people.

Table 1: Lakes Sampled in 1985 Self Help Program

Lake	County(s)	Township(s)
1. Baptiste	Hastings	Herschel
2. Bass	Leeds	Rear of Leeds & Lansdowne
3. Big Gull (Clarendon)	Frontenac	Kennebec, Olden Barrie, Clarendon
4. Big Rideau	Lanark, Leeds	S. Burgess, N. Burgess, S. Elmsley, N. Elmsley, Bastard
5. Black	Frontenac	Olden
6. Black	Lanark	North Burgess
7. Black Donald	Renfrew	Brougham
8. Blackfish Bay	Renfrew	Radcliffe
9. Bobs	Frontenac	Bedford
10. Brule (Wensley)	Frontenac	Miller
11. Buck - North Bay	Frontenac	Loughborough, Bedford, Storrington
12. Burridge	Frontenac	Bedford
13. Charleston	Leeds	Front/Rear of Yonge & Escott, Rear of Leeds & Lansdowne
14. Chippego	Frontenac	Hinchinbrooke
15. Christie	Lanark	Bathurst
16. Cranberry	Frontenac	Pittsburgh
17. Crosby	Leeds	North Crosby
18. Crowe	Hastings, Peterborough	Marmora, Belmont
19. Davern	Lanark	S. Sherbrooke
20. Dempseys (Virgin)	Renfrew	Bagot & Blythfield
21. Desert	Frontenac	Loughborough

22. Devil	Frontenac	Bedford
23. Diamond	Hastings	Herschel
24. Dickey	Hastings	Lake
25. Eagle	Frontenac	Hinchinbrooke
26. Elbow	Frontenac	Hinchinbrooke
27. Faraday (Trout)	Hastings	Faraday
28. Farren (Farrell)	Lanark	S. Sherbrooke
29. Gananoque	Leeds	Rear of Leeds & Lansdowne, Front of Leeds & Lansdowne
30. Grippen	Leeds	Rear of Leeds & Lansdowne
31. Hay Bay	Lennox & Addington	Fredericksburgh
32. Indian	Leeds	South Crosby
33. Jeffrey	Hastings	Faraday
34. Joeperry	Lennox & Addington	Effingham
35. Killenbeck	Leeds	Rear of Leeds & Lansdowne
36. Limerick	Hastings	Limerick
37. Little Cranberry	Leeds	Rear of Leeds & Lansdowne
38. Little Silver	Lanark	S. Sherbrooke
39. Loughborough	Frontenac	Storrington, Loughborough
40. Lower Beverly	Leeds	South Crosby
41. Mazinaw	Frontenac, Lennox & Addington	Abinger, Barrie
42. Mississippi	Lanark	Drummond, Beckwith, Ramsay
43. Moira	Hastings	Huntingdon
44. Mosque	Frontenac	Miller, Clarendon

45. Muskrat	Renfrew	Westmeath, Ross
46. Norway	Renfrew	Bagot & Blythfield
47. Olmstead (Jefferys)	Renfrew	Ross
48. Opinicon	Frontenac, Leeds	Bedford, Storrington, South Crosby
49. Otter	Leeds	Bastard, South Elmsley
50. Otty	Lanark	North Burgess, North Elmsley
51. Papineau	Hastings	Wicklow, Bangor
52. Paugh	Renfrew	Burns, Sherwood
53. Pike	Lanark, Leeds	North Burgess, North Crosby
54. Red Horse	Leeds	Rear of Leeds & Lansdowne
55. St. Andrew	Frontenac	Hinchinbrooke
56. St. Peter	Hastings	McClure
57. Salmon Trout	Hastings	Monteagle
58. Sand	Leeds	South Crosby
59. Shabomeka	Frontenac	Barrie
60. Sharbot	Frontenac	Olden
61. Silver	Frontenac, Lanark	Oso, South Sherbrooke
62. Skootamatta	Lennox & Addington	Anglesea
63. Steenburg	Hastings	Tudor, Limerick
64. Stoco	Hastings	Hungerford
65. Thirteen Island	Frontenac	Bedford, Hinchinbrooke, Loughborough, Portland

66. Troy	Leeds	South Crosby
67. Twin Sister	Hastings	Marmora
68. West	Lennox & Addington	Sheffield
69. White	Lanark, Renfrew	Darling, Bagot & McNab

2.0 METHODS

Volunteers who contacted MOE to assist in the Self Help Program were provided with a sampling device, a Secchi disc, glass bottles, sample preservative, return shipping material including submission forms, and detailed sampling instructions. Each participant was asked to select a sampling location at a central or open water site in the lake well removed from any localized shoreline influence. Samplers were instructed to undertake water clarity measurements weekly or bi-weekly during the ice-free season depending upon their availability at the lake.

For recreational lakes, one of the most important and most easily measured water quality parameters is water clarity. Water clarity is determined by lowering a Secchi disc vertically into the water; the depth at which it disappears from view is a measure of water clarity. A Secchi disc is a circular steel plate 20 cm (8 inches) in diameter painted white and black in opposing quadrants (Figure 1).

Water clarity is affected by the amount of phytoplankton, i.e. microscopic algae, that inhabit a lake. As the amount of phytoplankton increases, the water becomes progressively more turbid and water clarity correspondingly declines. The amount of algae in a unit of water may be determined by enumerating the number of individual cells or algal colonies under a microscope. However, this is a slow tedious procedure. To circumvent the need for labour intensive cell enumerations, a simpler method is employed. The amount of green pigment called chlorophyll a, which is a component of all green plants, is chemically measured. The amount of chlorophyll a in a sample of water provides an estimation of the amount of phytoplankton in the lake at the time of sampling. In the following sections of this report the chlorophyll a values will be referred to simply as chlorophyll values.

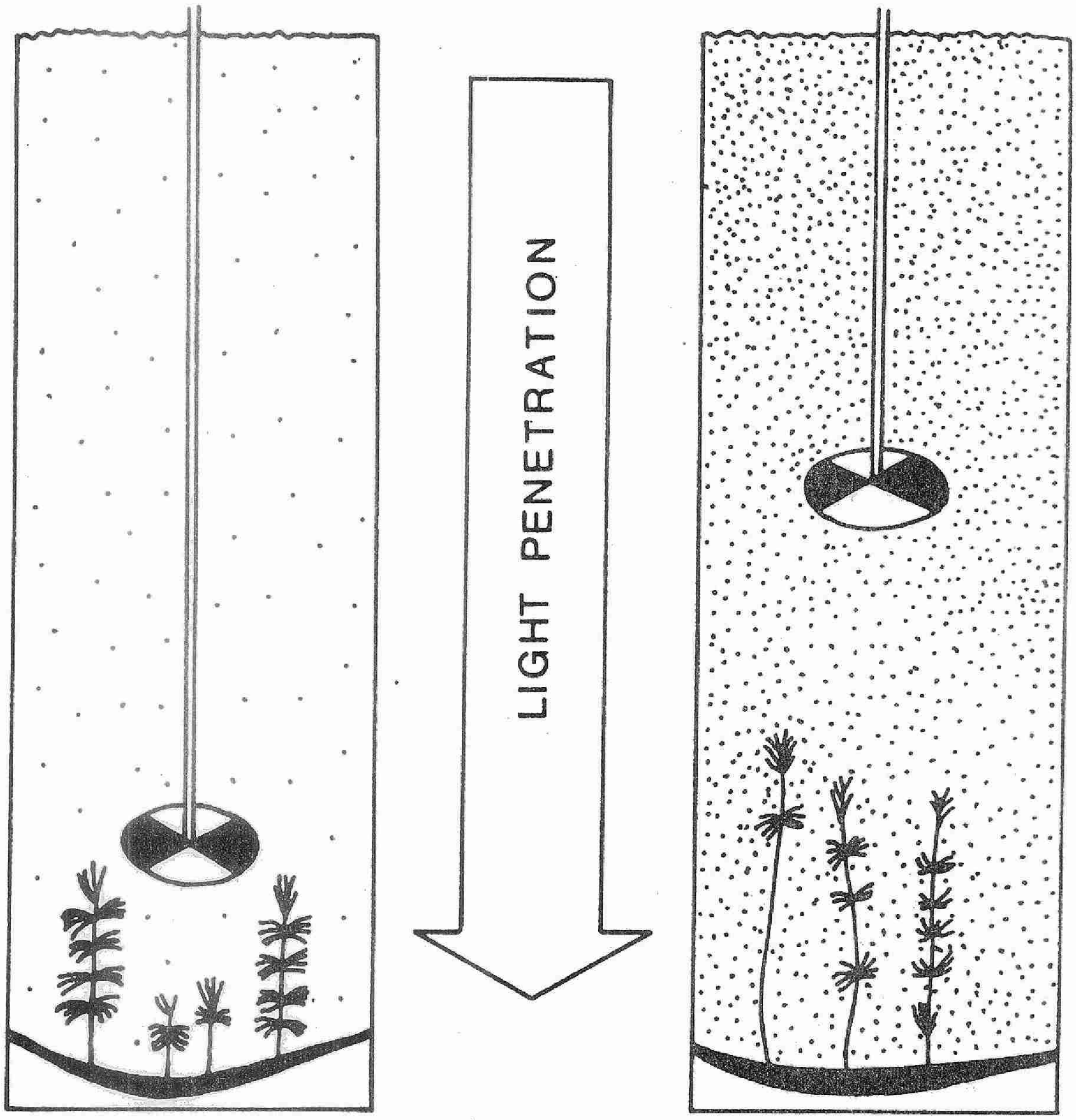


Figure 1: Diagram illustrating the use of a Secchi disc to measure water clarity. Greater visibility characterizes clear lakes having low algal densities (left panel) than productive lakes which contain high algal levels and have low light penetration (right panel)

Algae cease to grow in a lake because of insufficient light for photosynthesis at a depth approximated by twice the Secchi disc visibility depth. Water samples were collected at the same time as water clarity measurements were made by lowering a narrow-mouthed, one-litre bottle in a weighted sample bucket to twice the Secchi disc depth measurement, i.e. the lower limit of the zone of phytoplankton growth.

The speed of lowering and raising the sampler was regulated by trial and error repetition so that the bottle just filled as it reached the surface. In this manner a composite sample equally representative of all depths from the measured water column was collected. The samples were preserved immediately after collection with 0.5 ml (five drops) of one half percent magnesium carbonate suspension to minimize degradation of chlorophyll pigment and were delivered as soon as possible, usually within a day or two, to the MOE laboratory at Kingston via COD shipment.

Water samples were filtered using a 1.2 micron nylon filter, the residue extracted with 90% acetone and the chlorophyll a concentrations determined spectrophotometrically according to standard methods of the Ministry of the Environment. Prior to 1985 samples were filtered on a cellulose nitrate filter. A change to a nylon filter was made in 1985 to obtain better recovery of chlorophyll from the filtered samples.

Each sample was submitted with a Sample Submission Form which included the sampler's name and address, the lake, location sampled, weather and water surface conditions, and the Secchi disc reading.

3.0 RESULTS AND DISCUSSION

A summary of the number of samples, mean (average) Secchi disc visibility depths and chlorophyll concentration measurements for each lake are provided in Table 2, while individual results for every date that samples were collected are presented alphabetically by lake in Appendix 1. In addition, Appendix 2 summarizes in graphic form, mean Secchi disc visibility depths and mean chlorophyll concentrations for all lakes for those years where there were six or more sets of measurements.

Some lakes are represented by more than one sampling location. This is necessary for lakes that are divided into two or more distinct basins such as Loughborough and Twin Sister or that are comprised of a number of separate bays that may act independently from a water quality point of view (e.g. Bobs Lake). More than one sampling location may be desirable for large or irregularly shaped lakes like White or Desert where localized variations in chlorophyll concentrations or water clarity might be expected to occur. In all, 926 samples were collected at a total of 82 sampling locations.

Since water clarity and chlorophyll concentrations vary from one sampling event to the next, a certain minimum number of measurements is necessary to provide a representative sampling of the water quality of a lake. This minimum number will depend on the degree of variability exhibited by the lake. Lakes with a lot of variability require more sampling than lakes where water quality does not change much from day to day or seasonally. With few exceptions, no attempt has been made in this report to interpret the results for lakes where less than six sets of measurements were collected over any single year.

WATER CLARITY

In general, the results indicate that the water clarity for most of the lakes in the 1985 program was quite good for all recreational uses. As a seasonal average, Secchi disc visibility depths ranged from 1.5 metres for Stoco Lake to 7.2 metres for

Table 2: Summary of mean Secchi disc and mean chlorophyll results for 82 locations on 69 lakes in the 1985 Southeastern Region Self Help Program

LAKE	MSECCHI (m)	MCHLORA (ug/L)	NSECCHI	NCHLORA
Baptiste Lake	3.37	1.70	3	3
Bass Lake	6.27	1.77	7	6
Big Gull	4.20	2.35	14	13
Big Rideau	3.68	3.11	14	15
Black	4.60	2.21	10	9
Black Donald	5.71	1.74	10	8
Black-N.Burgess Twp.	4.83	3.28	12	10
Blackfish Bay	4.77	2.73	7	7
Bobs (East basin)	4.52	4.57	9	9
Bobs (Green Bay)	5.80	1.82	7	6
Bobs (Long Bay)	2.78	5.08	5	4
Bobs (Mud Bay)	3.05	5.45	6	6
Bobs (West basin)	4.13	2.72	6	6
Brule	7.22	1.79	16	14
Buck (North Bay)	3.47	4.88	35	35
Burridge	4.93	2.14	17	13
Charleston (Goose Island)	4.20	2.29	8	8
Charleston (Websters Bay)	4.46	2.23	8	8
Charleston (Western Watr)	4.61	2.11	8	7
Chippego	3.57	6.11	13	13
Christie	4.55	5.47	6	6
Cranberry	2.40	3.70	3	3
Crosby	4.27	3.89	9	8
Crowe	2.49	4.14	7	7
Davern	5.69	1.63	15	13
Dempsey (Virgin)	5.25	2.50	6	6
Desert	4.41	3.04	30	30
Devil	5.50	2.25	16	15
Diamond	5.88	2.27	4	3
Dickey (North end)	4.11	2.03	9	8
Dickey (South end)	4.60	1.90	9	7
Eagle	5.40	2.36	18	18
Elbow	3.23	6.33	6	6
Faraday	6.08	1.55	6	6
Farren	5.04	1.78	8	8
Gananoque	2.55	7.63	8	8
Gananoque (Lost Bay)	3.79	2.39	7	8
Grippen	3.60	4.19	8	8
Hay Bay	1.25	24.15	2	2
Indian	4.27	3.55	13	13
Jeffrey	6.98	1.75	8	8
Joeperry	2.84	2.87	10	10
Killenbeck	3.10	6.11	17	17
Limerick	4.57	2.22	9	9
Little Cranberry	1.77	9.03	3	3
Little Silver	3.96	3.86	32	31
Loughborough (E. Basin)	2.63	6.36	15	16
Loughborough (W. Basin)	6.18	2.78	4	4
Lower Beverley	1.68	13.55	8	8
Mazinaw	3.60	1.65	15	11
Mississippi	3.30	4.19	8	7
Moira	1.96	14.73	14	14
Mosque	4.91	1.75	14	12
Mosque (N.W. Basin)	3.71	3.13	7	7

Table 2: Summary of mean Secchi disc and mean chlorophyll results for 82 locations on 69 lakes in the 1985 Southeastern Region Self Help Program

	LAKE	MSECCHI (m)	MCHLORA (ug/L)	NSECCHI	NCHLORA
	Muskrat	4.38	3.47	6	6
	Norway	5.15	1.48	4	4
	Olmstead	5.35	5.78	4	4
	Opinicon	3.06	3.78	19	19
	Otter	2.98	2.29	12	12
	Otty	4.68	2.51	22	24
	Papineau	7.76	2.53	5	4
	Paugh	5.51	1.42	7	5
	Pike	2.60	5.46	8	8
	Red Horse (East Basin)	3.76	3.96	14	14
	Red Horse (West Basin)	3.24	5.60	15	14
	Saint Andrew	3.35	2.75	11	11
	Saint Peter	3.95	1.45	4	4
	Salmon Trout	3.27	9.80	7	6
	Sand	3.41	5.09	19	19
	Shabomeka	4.27	2.54	12	11
	Sharbot	4.45	2.70	10	10
	Silver	3.70	2.34	11	11
	Skootamatta	3.49	2.26	11	11
	Steenburg	4.20	3.07	3	3
	Stoco (North Basin)	1.61	9.99	18	16
	Stoco (South Basin)	1.48	11.92	18	17
	Thirteen Island	3.53	3.69	15	16
	Troy	2.60	8.54	15	15
	Twin Sister (East Basin)	3.63	4.68	10	10
	Twin Sister (West Basin)	3.83	8.73	8	8
	West	3.58	7.95	12	12
	White	2.42	7.76	48	45
MIN		1.25	1.42		
MAX		7.76	24.15		
MEAN		4.0355	4.3206		
VALIDN		82	82		

NSECCHI number of Secchi disc measurements
NCHLORA number of chlorophyll measurements

MSECCHI mean Secchi disc measurement
MCHLORA mean chlorophyll measurement

Brule Lake. For swimming and bathing, the MOE objective for safe useability states that water should have a Secchi disc transparency of at least 1.2 metres (4 feet). Only Stoco Lake and Moira Lake failed to meet that objective. Moira Lake had a single reading of less than 1.2 metres on August 27 coinciding with a peak chlorophyll concentration of 42 ug/L. Stoco Lake experienced poor water clarity throughout most of July, August and September. That entire period was one of extremely high algal productivity for Stoco Lake.

Of course, from purely an aesthetic point of view much better water quality is desirable. Mean Secchi disc visibility depth was greater than 3 metres in 80% of the lakes and greater than 4 metres in 48% of the lakes.

While Secchi disc visibility depth is an inexpensive, simple and readily understandable measurement of water quality it is somewhat subjective depending upon the observer taking the measurement. It is subject to interference by factors not related to the amount of algae in the water such as water colour, turbidity and water turbulence due to wave action or by glare caused by the reflection of light off the lake surface. Water turbulence and glare make it difficult to accurately determine the exact depth at which the disc disappears from view. Chlorophyll concentrations, although neither a direct nor proportional measure of algal biomass, are nevertheless free from these interferences and provide a more objective quantification of a lake's enrichment status. The remainder of the discussion will focus primarily on chlorophyll concentrations rather than on Secchi disc depths.

CHLOROPHYLL CONCENTRATIONS

Seasonal mean chlorophyll concentrations varied from 1.6 ug/L for Davern Lake to 14.7 ug/L for Moira Lake. Experience seems to indicate that a seasonal mean chlorophyll concentration of 5 ug/L is a level below which water quality problems attributable to excessive levels of algae rarely occur.

Of the lakes in Table 2 with six or more sets of measurements only 13 had a seasonal mean chlorophyll concentration in excess of this value. Although peak chlorophyll concentrations indicative of algal bloom conditions were measured for some of these lakes, the absence of any complaints of nuisance algal conditions probably indicates that most of them still had multiple use recreational water quality with few of the adverse effects normally associated with algae blooms.

CHLOROPHYLL CONCENTRATIONS AND WATER CLARITY

As pointed out above, Secchi disc visibility is a measure of the depth to which light penetrates in a lake and chlorophyll is a photosynthetic pigment found in green plants. The concentration of chlorophyll in a sample of water from the lake reflects the amount of algae present. Since light penetration is affected by the amount of algae, an inverse correlation exists between mean chlorophyll concentrations and mean Secchi disc visibility depths for a series of lakes of varying degrees of nutrient enrichment.

The curve in the graph of Figure 2 represents this inverse relationship for the lakes in Table 2 with six or more sets of measurements during 1985. Lakes with very low levels of algae and correspondingly extremely clear water, Brule, Bass and Jeffrey are situated near the vertical arm of the curve in the upper, left area of the graph. Lakes with high levels of algae and reduced water clarity, Stoco, Lower Beverly and Moira are situated near the horizontal arm of the curve in the lower right area of the graph. The majority of lakes are clustered about the mid section of the curve in the centre of the graph.

The graph shows that Secchi disc visibility is very sensitive to changes in algal densities at low chlorophyll concentrations but insensitive at high concentrations. At very low chlorophyll concentrations, small changes have a large impact on water clarity, while at higher chlorophyll concentrations even large changes have little impact on water clarity. In practical terms, there are limits within which changes or reductions in chlorophyll concentrations will reduce or improve water clarity in our more productive lakes.

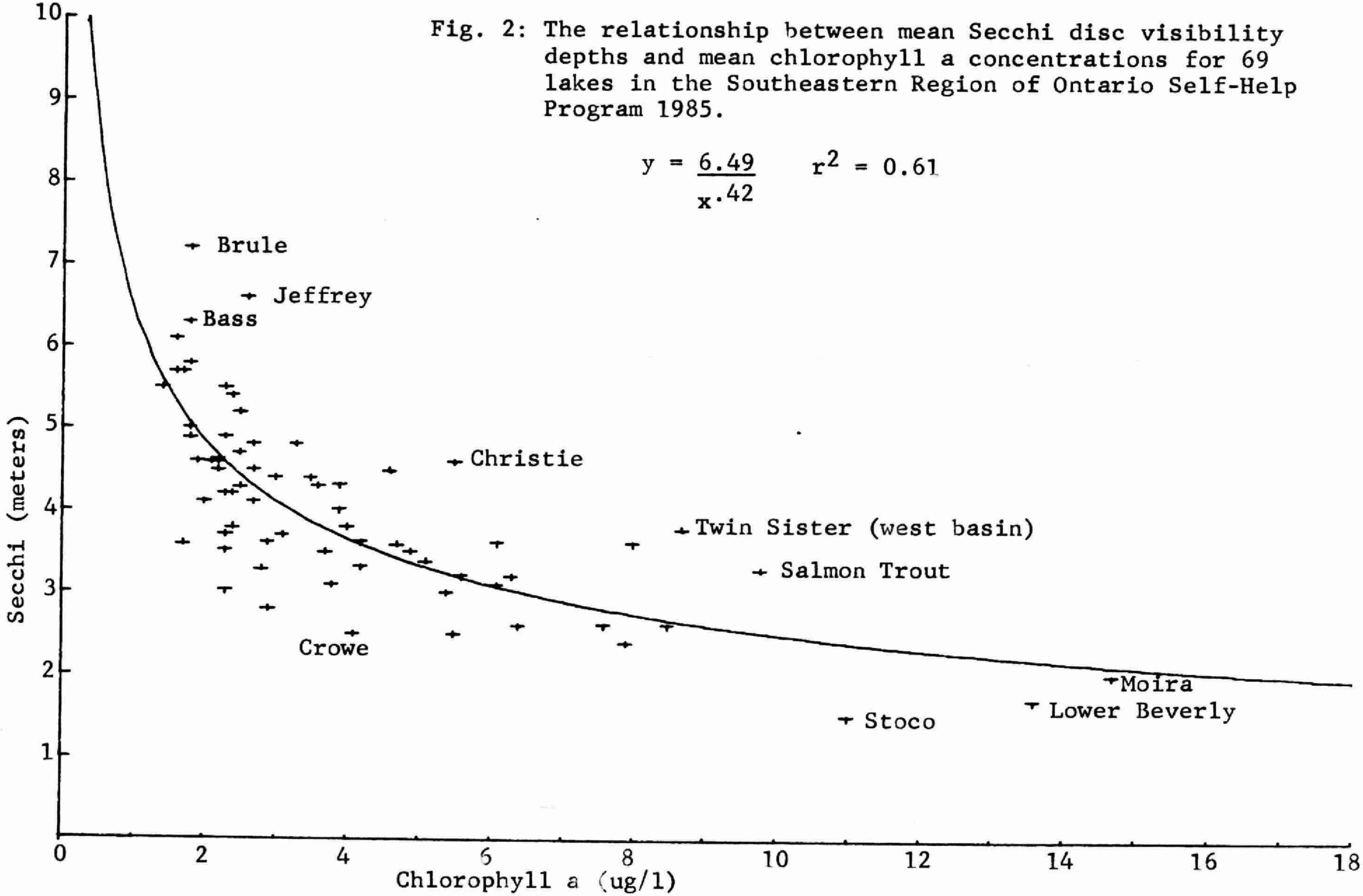


Fig. 2: The relationship between mean Secchi disc visibility depths and mean chlorophyll a concentrations for 69 lakes in the Southeastern Region of Ontario Self-Help Program 1985.

$$y = \frac{6.49}{x^{.42}} \qquad r^2 = 0.61$$

SEASONAL VARIATIONS IN CHLOROPHYLL CONCENTRATIONS

The chlorophyll concentration results indicate that for some lakes the algal growth varies in intensity at different seasons of the year. The predominant seasonal pattern (winter excluded) is one of gradually increasing chlorophyll concentrations rising to a peak in late summer or early fall. For some of these lakes there may also be a weak spring pulse. The pattern of a weak spring pulse and a fall peak in the abundance of algae is best exemplified by the bimodal distribution of chlorophyll concentrations for Buck, Desert and Little Silver lakes (Figure 3). During the spring pulse in Desert Lake chlorophyll concentrations were higher than those recorded during the remainder of the year.

Several years worth of data are needed to ensure that seasonal cycles are indeed due to an intrinsic property of the phytoplankton population of a lake and not simply a sampling artifact. Desert Lake has not previously exhibited any bimodal pattern in chlorophyll concentrations. A fall peak in algal productivity, but not a spring pulse, has occasionally been a feature of Buck, Desert and Little Silver Lakes in past years. Other lakes that exhibited much higher chlorophyll concentrations during late summer and early fall (during 1985) include the East Basin of Bobs Lake, Christie Lake, Crowe Lake and Gananoque Lake. Of these, only Christie Lake has followed this pattern for a number of years.

In other lakes prolonged periods of elevated chlorophyll concentrations are more or less confined to the warmer water temperatures and long day lengths of summer, as illustrated by the sampling results for Moira, Stoco, Killenbeck and White lakes (Figure 4).

Because of the volunteer nature of the Self Help Program, sampling is often carried out only during the summer months, when cottagers are at the lakes. The presence or absence of elevated levels of algae during the spring or fall or other seasonal trends cannot be confirmed. That does not mean that a program during June, July

and August is without any value. Quite to the contrary, it documents the water quality of a lake during the months of peak recreational use. What is important to realize is, that as a result of seasonal variation, the period of sampling can influence the results. This should be taken into account during any comparative interpretation of the data.

A comparison of the data for Troy and Salmon Trout lakes, two very similar lakes in terms of their physical characteristics and enrichment level, illustrate this point quite well. The average chlorophyll concentration for Salmon Trout Lake is 9.80 ug/L compared to an average chlorophyll concentration of 8.54 ug/L for Troy Lake. The average values tend to indicate that Salmon Trout Lake is slightly more productive than Troy Lake. Reference to the entire data sets for the two lakes (Appendix 1) reveals that sampling did not begin on Salmon Trout Lake until July when algal levels in both lakes are quite high, while the Troy Lake data includes samples collected during May and June when algal levels are much lower. If the mean chlorophyll concentration for Troy Lake is calculated over the same time interval that samples were taken on Salmon Trout Lake the mean is 11.36 ug/L. Troy Lake is thus shown to be the more productive body of water. The lack of comparability in the sampling intervals makes the comparison of two lakes inappropriate without due consideration given to the differences in their respective sampling regimes. Obviously, the same precaution applies equally to comparisons between mean values for the same lake from year to year.

While sampling programs that encompass the normal growing season for aquatic plants and algae are necessary to document the presence of spring or fall peaks in chlorophyll concentrations, it should be recognized that peaks can occur at any time of the year. The 1985 data sets in Appendix 1 contain numerous examples of lakes with peaks in chlorophyll concentrations that do not fit into any seasonal pattern. Examples of these lakes are provided in Figure 5 and also include Mississippi (6.4 ug/L on July 14, 7.7 ug/L on September 3 and 7.9 ug/L on September 10), Grippen (7.6 ug/L on September 11), Elbow (12.4 ug/L on July 27) and Burridge (6.8 ug/L on October 21).

These chlorophyll values represent algal concentrations well above the seasonal average for these lakes. It is difficult to say whether these single peak values are the result of contamination of the water sample with algal detritus, possibly by disturbance of the bottom sediment while sampling, the result of an analytical error in the laboratory, or whether they represent an actual increase in the phytoplankton biomass in the lake at the time of sampling.

Peaks in algal biomass can develop spontaneously and may persist for only very short periods of time, sometimes only a matter of days. Even a weekly sampling program can miss these situations. For example, in 1982 residents on Howes Lake reported the presence of a red scum on the surface that was immediately investigated and identified as a bloom of the algae Volvox. Regular chlorophyll and water clarity sampling by a recreational lake survey field crew failed to detect this bloom which developed between weekly visits to the lake.

Just as the influence of seasonal periodicity in lake productivity has to be taken into account when comparing seasonal mean chlorophyll concentrations, so must consideration be given to whether or not the sampling regime detects peak concentrations of short duration.

A case in point is a comparison in the water quality of Joeperry and Indian Lakes. At face value, a mean chlorophyll concentration for Joeperry Lake of 2.87 ug/L versus a mean chlorophyll concentration of 3.55 ug/L for Indian Lake would appear to indicate that Joeperry Lake has the better water quality. An examination of the entire data set (Appendix 1) for the two lakes leads to a different conclusion. The higher mean for Indian Lake is due to the detection of a value of 12.1 ug/L on July 18. Without this singularly high value the mean chlorophyll concentration of Indian Lake is 2.84 ug/L and the water quality of the two lakes is seen to be quite comparable. Conversely, peak levels may have occurred on Joeperry Lake between sampling events in which case its mean may have been biased toward a lower value.

The 1985 data for other lakes, particularly deep lakes at the lower end of the enrichment scale, reveal that many lakes have fairly uniform chlorophyll concentrations throughout the sampling period. There are 20 lakes with a standard deviation less than one-third the mean chlorophyll concentration. The standard deviation is a statistic that tells us how well the mean represents the data set. If the standard deviation is small, the values are consistent with one another and the mean is a good approximation of the condition of the lake.

Chlorophyll concentrations for Otter Lake and Black Lake are depicted in Figure 6 as examples of these types of lakes.

ANNUAL VARIATION IN CHLOROPHYLL CONCENTRATIONS

In the preceding section, the 1985 results are examined and discussed primarily for the purpose of providing a better understanding of a lake's water quality as it occurs within a single year.

A matter of greater interest is the variability which occurs from year to year. The Self Help Program enrollment includes an increasing number of lakes for which a data base now exists for a number of consecutive years. This information is valuable in assessing annual variability and is summarized numerically in Table 3 and graphically in Appendix 2.

One of the most obvious findings from a comparison of the 1985 data with the historical record is a fairly generalized and widespread increase in chlorophyll concentrations affecting most of the lakes enrolled in the program this year. To a large extent this increase in chlorophyll concentration was expected and can be attributed to an improvement in the laboratory procedure to filter the algae from the water samples submitted for chlorophyll analyses. A new type of filter was introduced to improve the recovery of chlorophyll. At present, further intercomparison

Fig. 3: Examples of lakes with a spring pulse and a fall peak in phytoplankton biomass as exemplified by a bimodal pattern of distribution of chlorophyll concentrations.

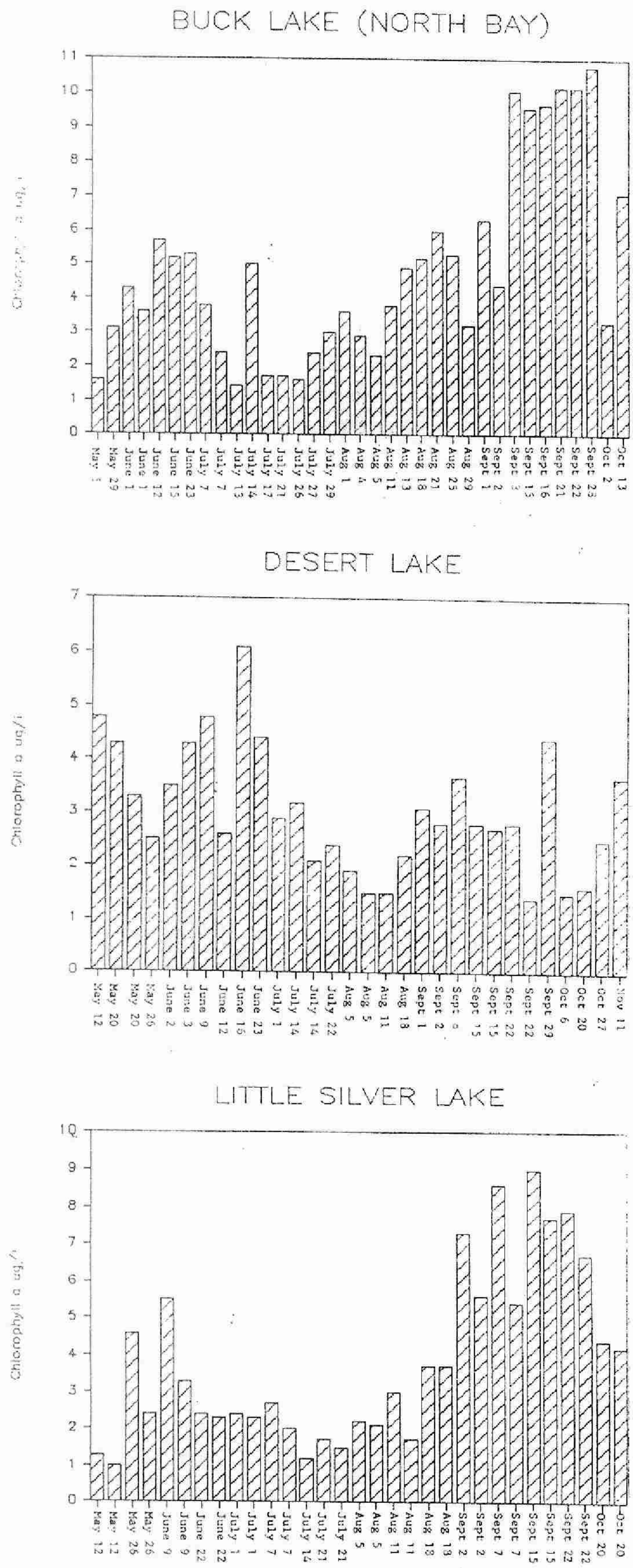


Fig. 4: Examples of lakes with increasing phytoplankton biomass during the summer as exemplified by chlorophyll concentrations.

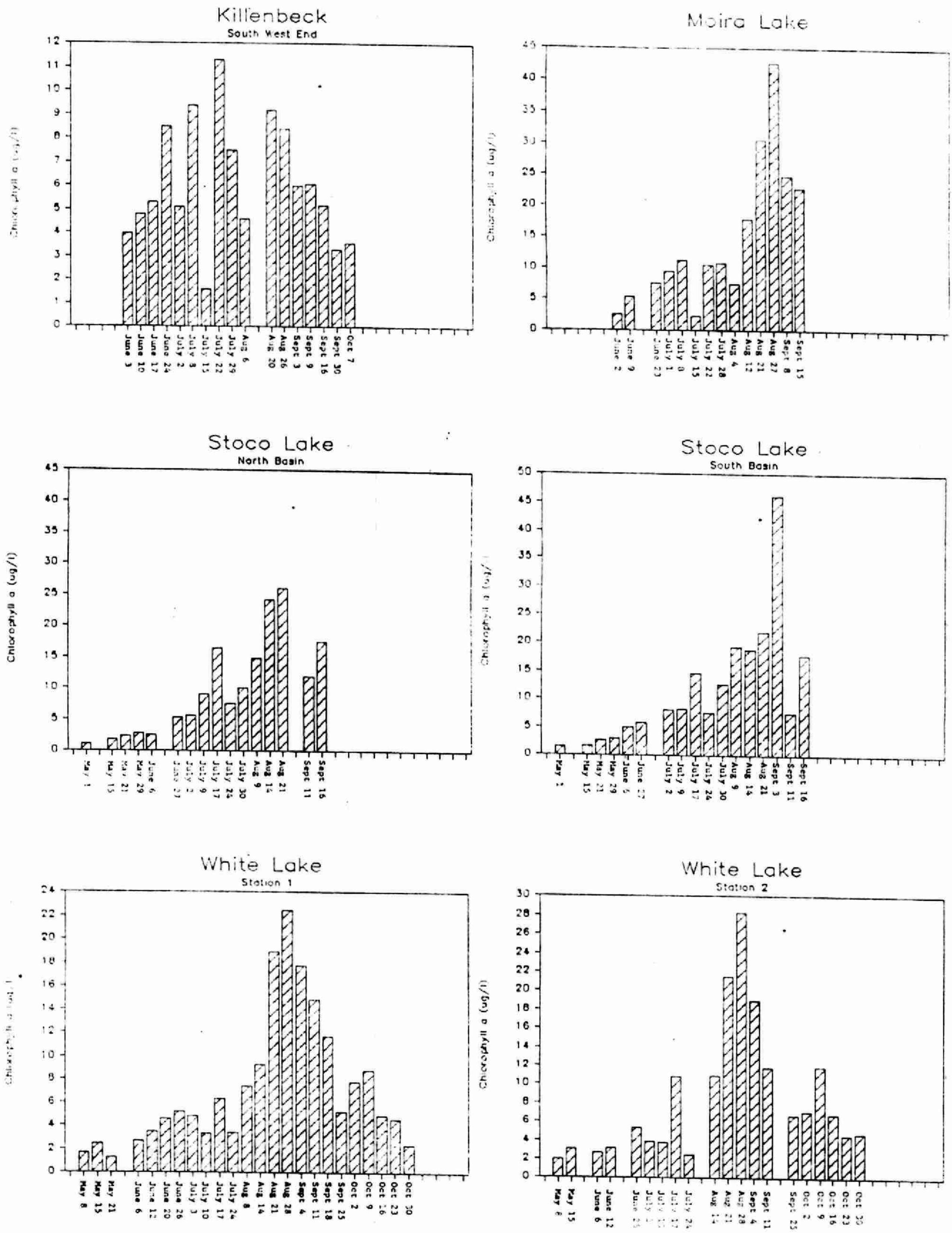


Fig. 5: Examples of lakes with peaks in chlorophyll concentration that occur randomly without any seasonal pattern.

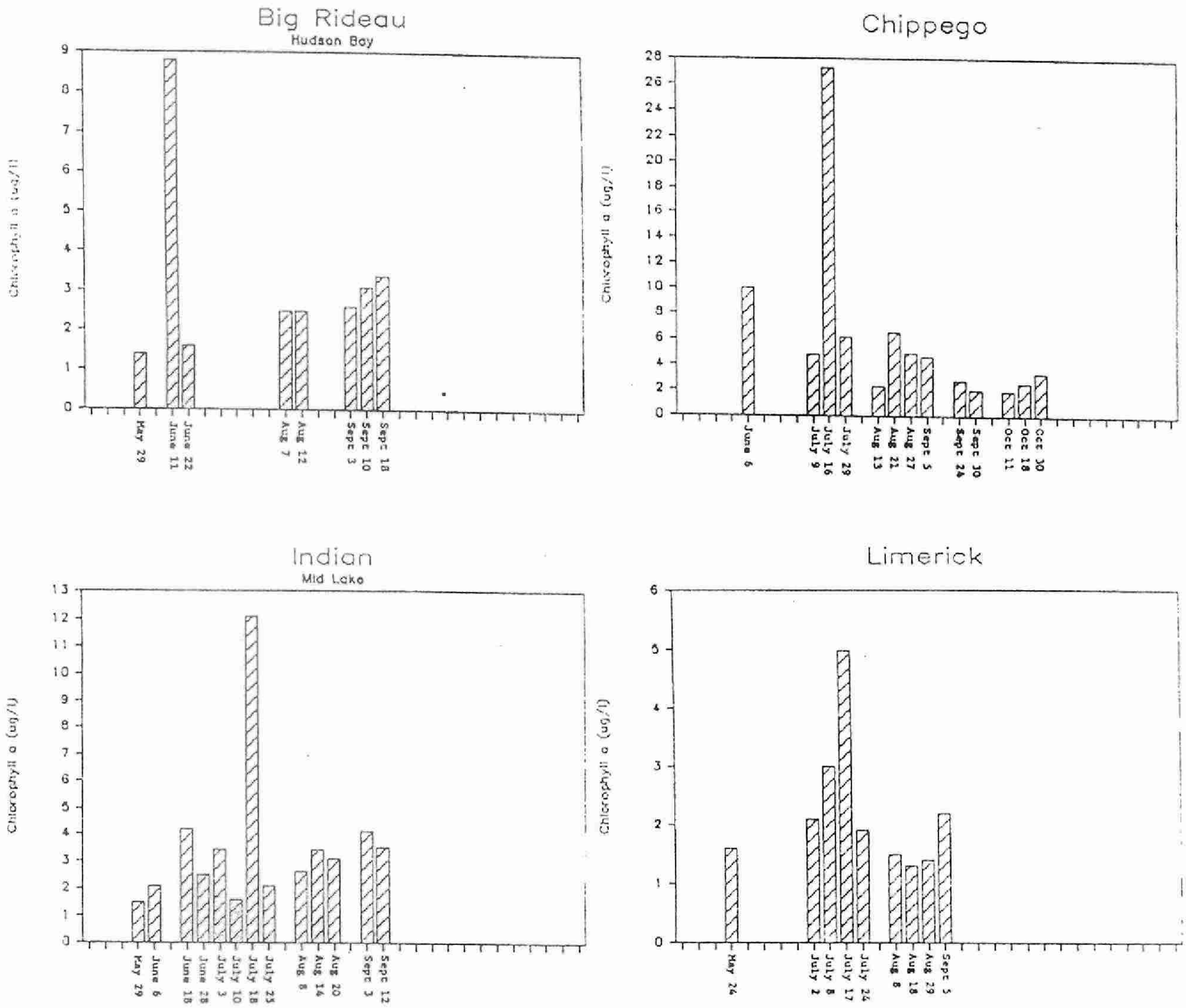
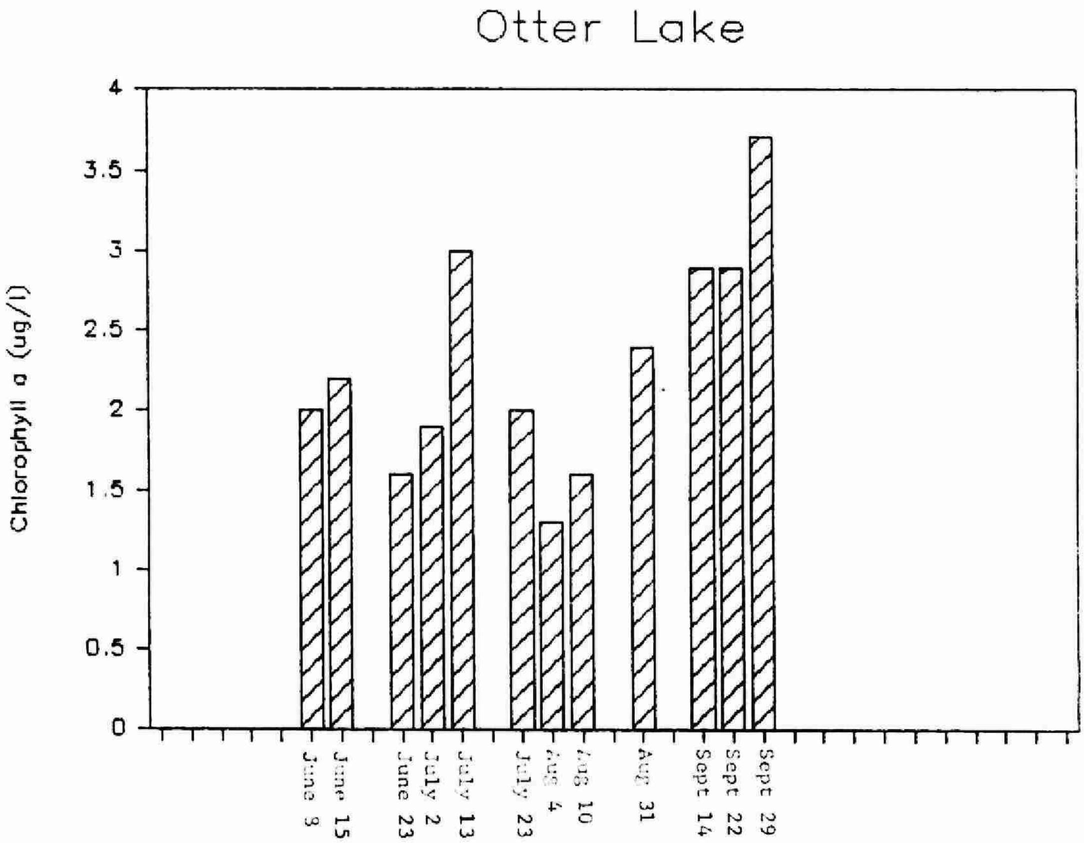
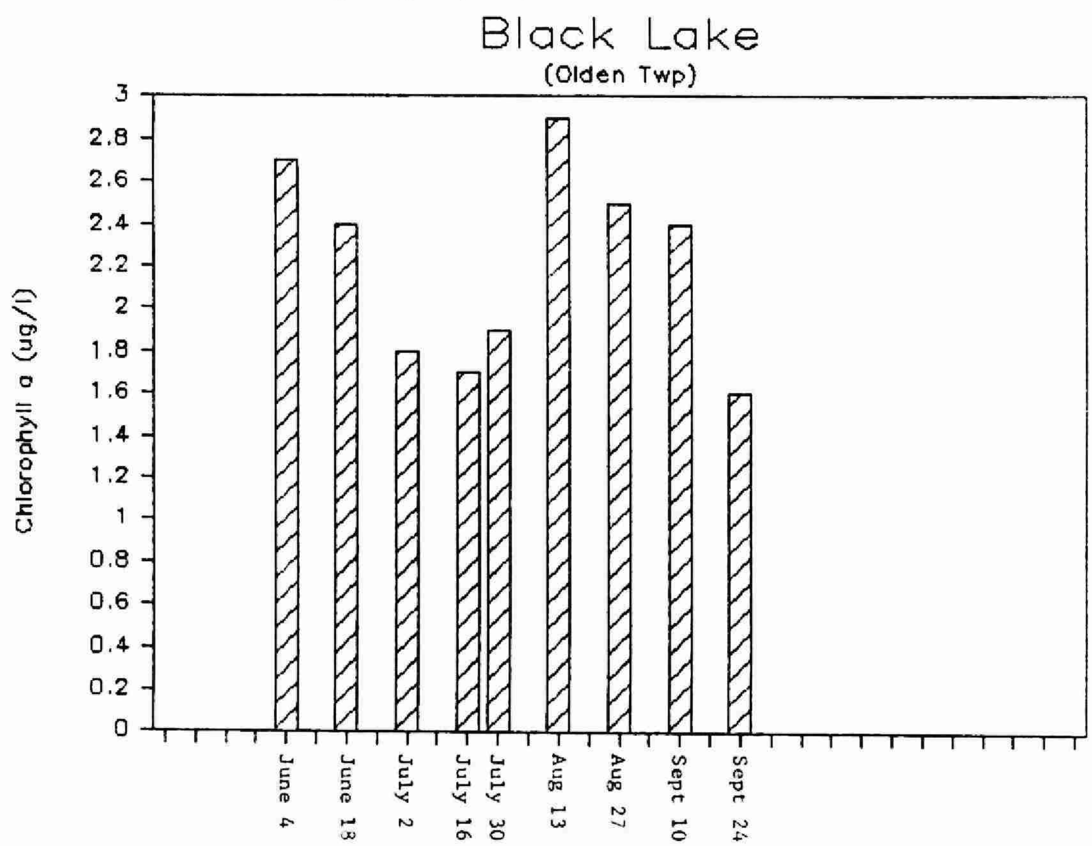


Fig. 6: Examples of lakes that have relatively uniform chlorophyll concentrations without any marked peaks in phytoplankton biomass.





between the two methods is required to correlate the historical data with the new technique. Based on a preliminary analysis by the Laboratory Services Branch, the improved recovery is about 50 per cent.

That means a 1985 chlorophyll concentration of a lake has to be 1.5 times the 1984 chlorophyll concentration before the lake can be said to have experienced a real increase in algal productivity. The ratio of 1985 chlorophyll concentrations to 1984 chlorophyll concentrations are tabulated in Table 3. There are nine lakes that exhibited a ratio greater than 1.5. For two of these lakes, Elbow and Lower Beverly, the 1985 mean chlorophyll concentration also exceeded their previously high mean concentration by a ratio of more than 1.5.

As with the data representing quality within any one year, caution must be applied in attempting to place too much interpretation to these comparative summaries since year to year sampling regimes may have introduced some bias into the data sets. It is impossible in a program of this nature to exactly duplicate sampling from year to year. It would be inappropriate and misleading to conclude merely on the basis of an exceedance of a mean chlorophyll concentration over a previous value that there was an indication of a trend towards worsening water quality condition in a lake.

In 1984 the mean chlorophyll concentration exceeded a previously recorded high values in two lakes - the west basin of Loughborough and Otty Lake. In both cases the 1985 mean chlorophyll concentration declined from the 1984 values to fall within the range of the historical record established for these lakes before 1984. The 1985 results for the west basin of Loughborough Lake are reported only in Table 2 and Appendix 1 as less than six sets of samples were collected.

Table 3: Comparison of 1985 Self Help Program Means with 1984 and earlier means derived from more than six sets of results See footnote for explanation of column headings

LAKE	SECC HI85	SECC HI84	RANGES	CHLO 85	CHLO 84	RANGEC	N	RATIC
	(metres)			(ug/L)				
Bass	6.3	6.6	4.7 - 6.6	1.8	1.7	0.8 - 2.1	8	1.1
Big Gull	4.2	4.0	3.4 - 4.6	2.4	1.9	1.7 - 3.3	7	1.3
Big Rideau	3.6	3.7	2.9 - 4.6	2.9	2.4	1.4 - 3.1	8	1.2
Black(Lanark)	4.8		3.7 - 5.8	3.3		1.6 - 4.0	3	
Black(Olden)	4.6	4.5	4.2 - 5.0	2.2	2.8	1.3 - 2.8	8	.8
Black Donald	5.7	5.3	4.2 - 5.6	1.7	1.9	1.1 - 2.2	3	.9
Blackfish Bay	4.8			2.7				
Bobs								
West Basin	4.1		3.2 - 4.3	2.7		2.6 - 4.6	5	
East Basin	4.5		3.6 - 5.0	4.6		1.6 - 3.7	5	
Green Bay	5.8		2.8 - 5.6	1.8		1.7 - 2.4	4	
Mud Bay	3.0	2.5	2.5 - 4.0	5.4	3.5	2.5 - 5.1	8	1.5
Brule	7.2	6.6	6.5 - 8.3	1.8	1.5	0.9 - 1.9	7	1.2
Buck								
North Bay	3.5	3.9	3.0 - 4.7	4.9	3.2	1.7 - 3.7	9	1.5
Burridge	4.9	4.1	4.4 - 5.6	2.3	2.0	0.7 - 2.4	5	1.2
Charleston								
Goose Is	4.2	3.4	3.6 - 4.4	2.3	2.5	1.7 3.3	7	.9
Websters Bay	4.5	3.5	3.5 - 4.5	2.2	1.9	1.5 - 3.5	8	1.2
West. Wtr.	4.6	3.3	3.3 - 4.8	2.1	1.8	1.8 - 3.7	7	1.2
Chippego	3.6	3.3	3.1 - 3.3	6.1	3.5	2.6 - 5.2	6	1.7
Christie	4.6		3.4 - 4.8	5.5		1.9 - 4.1	8	
Crosby	4.3	4.5	3.7 - 4.5	3.9	1.8	1.5 - 3.6	7	2.2
Crowe	2.5	2.7	2.4 - 4.7	4.1	3.2	1.6 - 3.2	8	1.3
Davern	5.7	5.2	4.7 - 5.3	1.6	1.7	1.1 - 1.9	5	.9
Desert	4.4	5.0	4.5 - 5.9	3.0	2.2	1.4 - 2.6	9	1.4
Dempseys	5.2	5.0	4.2 - 5.7	2.5	2.4	1.2 - 2.4	4	1.0
Devil	5.5	5.2	4.1 - 5.7	2.3	2.2	1.5 - 2.3	10	1.0
Dickey								
North Basin	4.1		4.2 - 5.3	2.0		1.1 - 1.9	7	
South Basin	4.6	5.0	4.5 - 5.2	1.9	1.9	0.8 - 1.9	6	1.0
Eagle	5.4	5.9	4.3 - 5.9	2.4	2.3	1.3 - 2.9	8	1.0
Elbow	3.2	3.1	2.4 - 3.3	6.3	3.8	2.2 - 3.8	3	1.7
Faraday	6.1		5.5 - 6.1	1.6		1.2 - 2.4	2	
Farren	5.0	4.8	4.7 - 5.7	1.8	1.9	1.2 - 2.0	6	.9
Gananoque	2.6	4.1	1.8 - 4.1	7.6	4.9	3.1 - 5.3	8	1.6
Lost Bay	3.8	3.0		2.4	3.7		1	.6
Grippen	3.6	2.4	2.4 - 3.9	4.2	3.0	2.1 - 4.6	10	1.4
Indian	4.3	3.7	3.6 4.6	3.6	2.5	1.5 - 3.6	7	1.4
Joeperry	2.8	3.0	3.0 - 5.6	2.9	2.0	1.6 - 2.5	7	1.5
Jeffrey	7.0	5.2	5.2 - 7.9	1.8	1.7	0.9 - 2.6	2	1.1
Killenbeck	3.1	2.6		6.1	4.0		1	1.5
Limerick	4.6	4.5	4.4 - 5.0	2.2	1.8	0.9 - 1.8	9	1.2
Little Silver	4.0	3.9	3.6 - 5.3	3.9	2.7	1.4 - 4.6	6	1.4
Loughborough								
East Basin	2.6	2.9	2.4 - 3.6	6.4	3.5	2.1 - 5.1	12	1.8
Lower Beverly	1.7	2.2	2.2 - 2.5	13.0	8.6	5.2 - 8.6	3	1.5
Mazinaw	3.6	4.0	3.5 - 5.7	1.7	1.5	1.0 - 1.7	9	1.1
Mississippi	3.3	3.1	2.5 - 4.3	4.2	3.9	1.6 - 9.1	11	1.1
Moira								

Comparison of 1985 Self Help Program Means
with 1984 and earlier means derived from more than six sets of results
See footnote for explanation of column headings

LAKE	SECC HI85	SECC HI84	RANGES	CHLO 85	CHLO 84	RANGEC	N	RATIO
	(metres)			(ug/L)				
East Basin	2.0	2.3	1.8 - 3.1	14.0	10.0	5.1 - 11.3	7	1.4
Mosque	4.9	5.2	5.0 - 6.3	1.8	1.8	0.9 - 1.8	9	1.0
Northwest	3.7	4.6	3.9 - 5.1	3.1	2.0	1.3 - 4.6	8	1.6
Muskrat	4.4	3.1	1.6 - 3.1	3.5	8.0	7.1 - 19.6	7	.4
Opinicon	3.1	3.1	2.8 - 3.3	3.8	3.9	2.2 - 3.9	9	1.0
Otter	3.0	3.0	2.7 - 3.4	2.3	2.1	1.4 - 2.4	10	1.1
Otty	4.7	4.1	3.9 - 4.7	2.5	2.8	1.1 - 2.8	12	.9
Paugh	5.5	4.8	4.8 - 5.5	1.4	1.6	0.9 - 1.6	7	.9
Pike	2.5		2.4 - 4.3	5.5		1.7 - 4.4	9	
Redhorse								
East Basin	3.8	3.0	2.7 - 3.8	4.0	4.9	2.6 - 5.2	5	.8
West Basin	3.2	3.0	3.0 - 3.8	5.6	4.7	2.8 - 6.1	7	1.2
St Andrew	3.3	3.1	1.7 - 3.1	2.8	3.6	2.3 - 10.5	6	.8
Salmon Trout	3.3	3.6	3.2 - 3.9	9.8	2.7	1.4 - 11.7	10	3.6
Sand	3.4	2.8	2.6 - 3.7	5.1	3.5	2.2 - 4.8	4	1.5
Shabomeka	4.3	5.2	4.4 - 5.2	2.5	2.1	1.8 - 2.5	4	1.2
Sharbot								
West Basin	4.5	4.3	4.1 - 4.8	2.7	2.6	1.8 - 2.7	10	1.0
Silver	3.7	3.4	3.4 - 4.0	2.3	2.0	1.3 - 2.4	9	1.2
Skootamatta	3.5	3.3	3.3 - 4.2	2.3	2.0	1.0 - 3.5	4	1.2
Stoco	1.5	1.2	1.2 - 2.4	11.0	16.0	3.9 - 16.7	5	.7
Thirteen Is.	3.5	3.8	3.3 - 4.3	3.7	2.9	2.3 - 2.9	3	1.3
Troy	2.6	2.4	1.7 - 2.9	8.5	5.3	3.9 - 8.0	9	1.6
Twin Sister								
East Basin	3.6	3.8	3.4 - 3.9	4.7	3.3	1.5 - 3.5	4	1.4
West Basin	3.8	3.5	3.5 - 4.4	8.7	3.1	1.7 - 3.1	6	2.8
West	3.6			8.0				
White	2.4	2.8	2.4 - 3.2	7.9	3.6	2.2 - 7.1	12	2.2

SECCHI85 mean Secchi disc visibility depth in metres for 1985

SECCHI84 mean Secchi disc visibility depth in metres for 1984

RANGES range in mean Secchi visibility depths up to 1984

CHLO85 mean chlorophyll concentration in ug/L for 1985

CHLO84 mean chlorophyll concentration in ug/L for 1984

RANGEC range in mean chlorophyll concentrations up to 1984

N number of years of participation in the program with six or more sets of measurements used to detirmine the range in the mean Secchi visibility depths and chlorophyll concentrations

RATIO the number of times by which the 1985 mean chlorophyll exceeded the 1984 mean chlorophyll concentration.

During 1985, Muskrat Lake demonstrated a marked improvement in water quality with the best mean Secchi disc visibility depth, 4.4 metres, and the lowest chlorophyll concentration, 3.5 ug/L, since its involvement in the Self Help Program. Although the assessment for Muskrat Lake in 1985 is based on only six sampling dates, they were collected in late summer, when Muskrat Lake has typically experienced poorest water quality coincident with the onset of algal blooms. This is the fifth consecutive year since 1981 that there has been a continued improvement in the water quality of Muskrat Lake documented by the Self Help Program. The beginning of the period of improvement coincides with the introduction of improved sewage treatment facilities for the Village of Cobden (population 983) in 1981 and efforts to reduce nutrient inputs from agricultural sources in the Snake River basin.

Stoco Lake also had better water quality during 1985. Stoco Lake was the subject of a water quality investigation by the MOE during 1984 in response to complaints of nuisance algae conditions. The investigation concluded that although Stoco Lake is extremely productive of weeds and algae, the nuisance conditions were likely an atypical event due to the accumulation of algae on a windward shore by wave action. This conclusion was substantiated by the previous documentation of water quality in Stoco Lake through the Self Help Program and lake surveys dating back to 1968. There were no complaints of algal blooms this year and chlorophyll concentrations were lower and water clarity better than last year.

Other lakes that demonstrated markedly better water quality during 1985 than during 1984 in terms of both lower chlorophyll concentrations and improved clarity are: Black (Olden Township), Black Donald, Brule, Charleston, Davern, Farren, Lost Bay, Otty, Paugh, east basin of Redhorse and St. Andrew.

In most cases, these annual variations in water clarity and chlorophyll content are minor and can be attributed to year to year differences in sunlight, rainfall and input of nutrients from the watersheds.

While natural background variability often obscures water quality trends, some lakes appear to have enough long term stability in their mean chlorophyll concentrations to confirm the absence of a trend. These lakes include Diamond, Dickey (north basin), Mazinaw, Otter, Otty, Mosque (main basin), Sharbot, Silver and Steenburg.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Over the past ten to twelve years, the Self Help Program has produced a wealth of scientific information which has significantly broadened the understanding of water quality conditions of lakes in Southeastern Ontario. The efforts of the Self Help Program participants continue to provide the information and opportunity for Ministry of the Environment scientists to study the biological productivity and water quality variability of lakes in southeastern Ontario. The Ministry is fortunate and grateful to have been provided over a decade of highly valuable data and looks forward to the continued participation of those involved and an expansion of the program to include additional lakes.

In terms of scientific value, each new year of data continues to reveal basic differences between lakes, patterns within lakes and a better understanding of between year variations in water quality conditions. For some lakes, the patterns in chlorophyll levels from spring to fall and the year to year average concentration are remaining stable and quite predictable. For other lakes a predictable pattern has not become evident. It is important that efforts continue in order that a clear fingerprint be established for as many lakes as possible.

In addition to the scientific value of the Self Help Program data, the coverage of lakes is extensive enough in terms of geographic distribution to provide a clear picture of the general status of water quality conditions of lakes throughout southeastern Ontario. Looking at the data as a whole, the picture which emerges is generally one of low biological productivity and excellent water quality conditions for all forms of recreational pursuits and passive enjoyment. Only a small proportion of the lakes in southeastern Ontario have occasional chlorophyll levels high enough to interfere with their use and enjoyment. It would be difficult to attempt to characterize the general water quality condition of the lakes of southeastern Ontario in this manner without the information provided through the Self Help Program.

Of a more practical value, the Self Help Program findings now provide much of the raw data used by the Ministry of the Environment for input into basic land use planning decisions for lakes in southeastern Ontario. The information is routinely provided to municipalities and their consultants involved in drafting land use planning policies for Official Plans and Zoning By-Laws. The information is also used directly by the Ministry of the Environment when providing its comments to municipalities and the Ministry of Housing and at Ontario Municipal Board hearings concerning shoreline development proposals.

Concerning the 1985 Self Help Program, the most evident finding was a generalized increase in measured chlorophyll levels in comparison with previous years. This increase coincides with a change in laboratory analytical procedures introduced by the Ministry during 1985. The change involved the use of a new type of filter to improve the recovery of chlorophyll. It is therefore probable that the 1985 chlorophyll results simply reflect an improved analytical procedure which recovers and measures a larger percentage of the chlorophyll present in a water sample. If so, it is reasonable to expect that the chlorophyll levels reported in subsequent years will continue to exceed those reported prior to 1985.

It is worthy of note that the 1985 Self Help Program results for Muskrat Lake continued to show a decline in chlorophyll concentrations which commenced five years ago. The decline, which has been more substantial than anticipated, commenced following the construction of improved waste treatment facilities at the Village of Cobden and an information program carried out at the same time to encourage farmers in the Muskrat Lake drainage basin to minimize the phosphorus runoff from their activities. A similar improvement in the water quality of Moira Lake was recorded and reported several years ago following the provision of improved waste treatment at the Village of Madoc.

The 1985 results for Stoco Lake are also worthy of specific mention in that more typical water quality conditions were re-established following the massive and troublesome algal bloom which occurred in Stoco Lake during 1984.

Everyone in the Self Help Program is encouraged to continue their participation in 1986.

Sampling should be carried out regularly and consistently over the entire period of residency at the lake. Weekly sampling would be desirable to define seasonal cycles where they exist. As a minimum, a program should encompass the three months of June, July and August when the lakes receive most of their use. Ideally, sampling should include the months of May and September as well to confirm the presence or absence of a spring or fall peak in algal abundance.

Cottagers who are located on lakes that are not presently enrolled in the Self Help Program are invited to contact the Ministry of Environment for advice and assistance in establishing sampling on their lake.

The Ministry of the Environment has a responsibility to minimize the potential water quality impact of further shoreline development on lakes in southeastern Ontario. Existing cottage owners can also play a vital role in the protection of lake water quality. The following Section outlines some of the steps cottagers can take to limit nutrient inputs and help protect the water quality of their lakes.

5.0 PROTECTION OF THE LAKE

Of the few management options available for dealing with water quality problems, the most effective is prevention. Nitrogen and phosphorus have been identified as critical elements in eutrophication. The nearshore region of a watershed contributes a disproportionate share of phosphorus and nitrogen relative to its area because of its proximity to the lake. It is important that cottagers and other waterfront owners do everything possible to ensure that their activities minimize these nutrient inputs to the lake. Following is a list of suggestions:

1) New cottage construction and septic systems should be sited well back from the water. This practice allows algae-producing nutrients in runoff and seepage from tile beds to be absorbed by soil and vegetation. Setbacks have the additional advantage of preserving the scenic beauty of the shore by preventing development from intruding unnaturally on the lake.

2) Site preparation and building activities should be carried out in a manner which will minimize disruption to the soil and vegetation. All areas that are exposed during construction should be replanted as soon as possible to prevent runoff and erosion.

3) Sewage disposal systems must be constructed in compliance with Provincial Regulations and be properly maintained. Seepage of leachate from improperly located or malfunctioning septic tank fields is suspected of contributing significant quantities of phosphorus to some heavily cottaged lakes. Septic tanks should be pumped out every three years and the area over the tile bed should be grassed and left open to sun and wind to encourage evapotranspiration. Protect the tile bed from damage by compaction from vehicular traffic including snowmobiles. Snowmobiles may compact the snow and

cause frost damage to the tiles. Check your waste disposal system annually for damp spots or ponding. If a problem with the system is apparent, or suspected, contact the local District Office of the Ministry of the Environment for guidance.

4) Minimize the quantity of water used for domestic purposes to avoid overloading the septic system. Dishwashers and automatic washing machines use large quantities of water. Moreover, a dishwasher detergent contains a high amount of phosphates which should be avoided for cottage use. Laundry should be taken to the city.

5) Don't shampoo or bathe in the lake. Many people find this practice offensive and in this day and age when most of us embrace an environmental ethic such practices should not occur.

6) Do not fertilize lawns. Excessive fertilizers will wash off into the lake and may promote unwanted nuisance aquatic growths.

7) The shallow nearshore or "littoral" zone supports most of the plant and animal life found in the lake. Disruption of any part of this ecosystem threatens the entire cycle of life in the lake. In particular, habitat for fish and other wildlife may be destroyed. Before undertaking any shoreline activities such as dredging or filling, contact the Ministry of Natural Resources (MNR) for advice. Prior approval may be required under the Navigable Waters Protection Act or the Fisheries Act.

8) Protect the natural shoreline. Retain a protective buffer of trees, shrubs and other ground cover between your cottage and the lake. Vegetation slows runoff and filters contaminants from roads, patios, parking lots, and cottage roofs. While once considered "natural", it is now known that such runoff

may be contaminated by sediment particles, phosphorus and nitrogen, animal excreta and fertilizer residue. During summer the vegetation uses nutrients which reach the ground water from septic tank systems.

In places where the natural vegetation has been removed, cottagers should plant new trees and shrubs to restabilize their shoreline.

The Ministry of Natural Resources (MNR) introduced a pilot shoreland revegetation project to Christie Lake near Perth in 1984. The program involves the active participation of cottage association members in re-establishing shorelines with natural vegetation for the purpose of enhancing the lake environment.

The MNR would be pleased to provide a presentation on this program to interested associations. Please contact the Ministry of Environment or your local district office of the Ministry of Natural Resources to arrange a presentation.

Appendix 1

Statistical summary for all Self Help Recreational Lakes - Chlorophyll in ug/L and Secchi disc results in metres for lakes in the 1985 Southeastern Region Self Help Program

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Baptiste Lake			
	85/07/31	3.4	1.2
	85/09/15	3.0	2.2
	85/09/15	3.7	1.7
MINIMUM		3.0	1.2
MAXIMUM		3.7	2.2
MEAN		3.367	1.700
STD DEV		.351	.500
Bass Lake			
	85/05/20	8.2	1.1
	85/06/02	5.2	1.9
	85/07/01	5.2	2.4
	85/08/05	6.1	.
	85/08/18	5.8	2.0
	85/08/28	6.7	1.9
	85/09/01	6.7	1.3
MINIMUM		5.2	1.1
MAXIMUM		8.2	2.4
MEAN		6.271	1.767
STD DEV		1.052	.480
Big Gull			
	85/05/19	3.2	.
	85/06/09	3.8	1.8
	85/06/16	3.8	4.0
	85/07/10	4.3	2.7
	85/07/18	4.1	1.2
	85/08/05	3.8	2.6
	85/08/10	4.6	1.9
	85/08/18	4.0	2.3
	85/09/04	4.0	1.8
	85/09/08	4.6	2.7
	85/09/15	4.8	2.2
	85/09/29	4.6	2.3
	85/10/06	4.6	2.3
	85/10/14	4.6	2.8
MINIMUM		3.2	1.2
MAXIMUM		4.8	4.0
MEAN		4.200	2.354
STD DEV		.459	.670

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Big Rideau			
	85/05/29	4.0	1.4
	85/06/11	3.7	8.8
	85/06/23	2.7	2.6
	85/07/01	5.8	3.1
	85/07/04	3.7	1.9
	85/08/05	3.4	2.2
	85/08/07	3.4	2.5
	85/08/08	.	2.0
	85/08/12	3.1	2.5
	85/09/03	3.0	2.6
	85/09/08	3.7	3.1
	85/09/10	3.0	3.1
	85/09/15	4.3	4.9
	85/09/18	3.4	3.4
	85/09/22	4.3	2.5
MINIMUM		2.7	1.4
MAXIMUM		5.8	8.8
MEAN		3.679	3.107
STD DEV		.776	1.768
Black			
	85/05/27	4.0	.
	85/06/04	4.3	2.7
	85/06/18	5.5	2.4
	85/07/02	4.3	1.8
	85/07/16	5.5	1.7
	85/07/30	4.9	1.9
	85/08/13	4.0	2.9
	85/08/27	4.6	2.5
	85/09/10	3.7	2.4
	85/09/24	5.2	1.6
MINIMUM		3.7	1.6
MAXIMUM		5.5	2.9
MEAN		4.600	2.211
STD DEV		.648	.470
Black Donald			
	85/02/09	6.4	1.5
	85/06/09	3.7	1.1
	85/07/01	5.8	.

STATISTICAL SUMMARY FOR ALL SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Black Donald			
	85/07/07	4.3	2.6
	85/07/27	5.5	1.1
	85/08/10	5.8	.
	85/08/18	6.1	1.3
	85/09/08	6.4	1.7
	85/09/22	7.0	1.7
	85/10/14	6.1	2.9
MINIMUM		3.7	1.1
MAXIMUM		7.0	2.9
MEAN		5.710	1.738
STD DEV		1.000	.672
Black-N.Burgess Twp.			
	85/06/10	5.2	.
	85/06/17	6.4	1.2
	85/06/24	6.2	.
	85/07/02	5.0	1.4
	85/07/09	5.2	1.5
	85/07/16	4.9	1.8
	85/08/06	4.0	4.0
	85/08/13	4.6	3.9
	85/08/20	5.0	3.8
	85/08/26	4.1	4.6
	85/09/09	3.5	4.8
	85/09/16	3.8	5.8
MINIMUM		3.5	1.2
MAXIMUM		6.4	5.8
MEAN		4.825	3.280
STD DEV		.894	1.660
Blackfish Bay			
	85/07/29	5.2	2.8
	85/08/06	3.7	2.5
	85/08/12	5.2	3.9
	85/08/19	4.9	3.3
	85/09/02	4.6	1.8
	85/09/10	5.2	2.6
	85/09/16	4.6	2.2
MINIMUM		3.7	1.8

LAKE	DATE	SECCHI	CHLORA
MAXIMUM		5.2	3.9
MEAN		4.771	2.729
STD DEV		.544	.697
Bobs (East basin)			
	85/07/	4.9	2.1
	85/07/08	5.3	1.5
	85/07/22	4.9	1.2
	85/08/06	5.2	1.9
	85/08/12	4.6	2.7
	85/08/18	4.6	6.7
	85/09/03	3.8	6.1
	85/09/15	4.0	8.3
	85/09/30	3.4	10.6
MINIMUM		3.4	1.2
MAXIMUM		5.3	10.6
MEAN		4.522	4.567
STD DEV		.653	3.440
Bobs (Green Bay)			
	85/07/08	6.7	1.7
	85/07/21	6.1	.
	85/08/05	5.5	1.4
	85/08/17	5.5	1.5
	85/09/02	4.9	2.4
	85/10/04	5.5	1.5
	85/10/21	6.4	2.4
MINIMUM		4.9	1.4
MAXIMUM		6.7	2.4
MEAN		5.800	1.817
STD DEV		.624	.462
Bobs (Long Bay)			
	85/08/05	2.9	.
	85/08/19	2.1	3.8
	85/09/02	2.9	4.7
	85/09/15	3.0	4.8
	85/10/13	3.0	7.0
MINIMUM		2.1	3.8
MAXIMUM		3.0	7.0
MEAN		2.780	5.075

LAKE	DATE	SECCHI	CHLORA
STD DEV		.383	1.360
Bobs (Mud Bay)			
	85/07/07	4.3	2.4
	85/07/23	3.7	3.5
	85/08/06	3.4	3.7
	85/08/19	2.1	9.8
	85/09/05	2.4	9.6
	85/o6/18	2.4	3.7
MINIMUM		2.1	2.4
MAXIMUM		4.3	9.8
MEAN		3.050	5.450
STD DEV		.878	3.328
Bobs (West basin)			
	85/06/03	4.9	3.1
	85/06/24	2.7	2.7
	85/07/15	4.9	1.9
	85/08/22	4.3	1.2
	85/09/18	3.7	1.5
	85/10/10	4.3	5.9
MINIMUM		2.7	1.2
MAXIMUM		4.9	5.9
MEAN		4.133	2.717
STD DEV		.833	1.716
Brule			
	85/07/07	7.3	.
	85/07/07	6.7	.
	85/07/14	7.6	5.8
	85/07/14	7.6	1.8
	85/07/28	7.6	2.1
	85/07/28	7.6	1.6
	85/08/08	7.3	1.3
	85/08/08	7.3	1.4
	85/08/23	6.9	1.2
	85/08/23	7.0	1.1
	85/08/25	6.7	1.7
	85/08/25	6.9	1.3
	85/09/14	6.9	1.4
	85/09/14	6.9	1.4
	85/09/15	7.3	1.4

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Brule			
	85/09/16	7.9	1.5
MINIMUM		6.7	1.1
MAXIMUM		7.9	5.8
MEAN		7.219	1.786
STD DEV		.371	1.184
Buck (North Bay,N end)			
	85/05/29	4.6	3.1
	85/06/01	3.7	4.3
	85/06/12	3.8	5.7
	85/06/15	3.7	5.2
	85/06/23	3.4	5.3
	85/07/07	3.8	3.8
	85/07/13	4.6	1.4
	85/07/21	3.8	1.7
	85/07/26	3.5	1.6
	85/07/27	3.8	2.4
	85/08/01	4.3	3.6
	85/08/04	3.5	2.9
	85/08/11	3.5	3.8
	85/08/13	3.8	4.9
	85/08/18	3.4	5.2
	85/08/25	3.4	5.3
	85/08/29	3.4	3.2
	85/09/01	3.4	6.3
	85/09/08	2.7	10.1
	85/09/15	3.2	9.6
	85/09/16	3.1	9.7
	85/09/21	2.6	10.2
	85/09/28	2.8	10.8
	85/10/02	2.7	3.3
MINIMUM		2.6	1.4
MAXIMUM		4.6	10.8
MEAN		3.521	5.142
STD DEV		.530	2.901
Buck (North Bay,N,end)			
	85/05/12	4.0	1.6
MINIMUM		4.0	1.6

LAKE	DATE	SECCHI	CHLORA
MAXIMUM		4.0	1.6
MEAN		4.000	1.600
STD DEV		.	.
Buck (North Bay,S end)			
	85/06/01	3.4	3.6
	85/07/07	3.5	2.4
	85/07/14	3.4	5.0
	85/07/17	4.0	1.7
	85/07/29	2.7	3.0
	85/08/05	3.4	2.3
	85/08/21	3.4	6.0
	85/09/02	3.2	4.4
	85/09/27	2.6	10.2
	85/10/13	3.5	7.1
MINIMUM		2.6	1.7
MAXIMUM		4.0	10.2
MEAN		3.310	4.570
STD DEV		.404	2.622
Burridge			
	85/05/04	7.0	.
	85/05/12	6.7	.
	85/05/22	5.5	.
	85/05/26	5.5	.
	85/06/09	4.0	1.3
	85/06/15	4.3	1.4
	85/06/23	4.6	1.8
	85/07/02	5.2	1.8
	85/07/08	4.6	1.5
	85/07/14	4.0	1.1
	85/07/21	5.2	1.6
	85/07/28	5.2	1.9
	85/08/03	5.2	1.1
	85/08/11	4.1	2.8
	85/08/20	4.0	2.7
	85/08/28	.	2.0
	85/10/21	4.7	6.8
	85/11/02	4.0	.
MINIMUM		4.0	1.1
MAXIMUM		7.0	6.8
MEAN		4.929	2.138
STD DEV		.907	1.497

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Charleston (Goose Island)			
	85/06/23	2.7	3.1
	85/07/08	5.1	1.8
	85/07/22	4.6	1.3
	85/07/29	4.6	1.7
	85/08/05	4.9	2.2
	85/08/12	4.3	3.4
	85/08/19	3.7	3.2
	85/09/03	3.7	1.6
MINIMUM		2.7	1.3
MAXIMUM		5.1	3.4
MEAN		4.200	2.288
STD DEV		.791	.825
Charleston (Websters Bay)			
	85/06/23	3.4	1.8
	85/07/08	5.2	2.0
	85/07/22	4.4	1.8
	85/07/29	4.6	1.7
	85/08/05	4.9	2.7
	85/08/12	5.2	3.5
	85/08/19	4.0	2.7
	85/09/03	4.0	1.6
MINIMUM		3.4	1.6
MAXIMUM		5.2	3.5
MEAN		4.463	2.225
STD DEV		.639	.671
Charleston (Western Watr)			
	85/06/23	3.5	1.7
	85/07/08	5.5	1.8
	85/07/22	4.4	.
	85/07/29	4.3	1.4
	85/08/05	4.9	2.5
	85/08/12	5.2	3.0
	85/08/19	4.8	2.8
	85/09/03	4.3	1.6
MINIMUM		3.5	1.4
MAXIMUM		5.5	3.0
MEAN		4.613	2.114

LAKE	DATE	SECCHI	CHLORA
STD DEV		.624	.639
Chippego			
	85/06/06	3.0	10.0
	85/07/09	3.5	4.8
	85/07/16	3.7	27.3
	85/07/29	3.7	6.2
	85/08/13	3.6	2.3
	85/08/21	3.5	6.5
	85/08/27	4.0	4.9
	85/09/03	3.8	2.1
	85/09/05	3.5	4.6
	85/09/24	3.5	2.8
	85/10/11	3.4	2.0
	85/10/18	3.8	2.6
	85/10/30	3.4	3.3
MINIMUM		3.0	2.0
MAXIMUM		4.0	27.3
MEAN		3.569	6.108
STD DEV		.246	6.760
Christie			
	85/07/20	6.1	1.3
	85/08/10	5.2	3.1
	85/08/17	4.9	2.7
	85/09/02	4.3	5.7
	85/09/08	3.7	8.9
	85/09/22	3.1	11.1
MINIMUM		3.1	1.3
MAXIMUM		6.1	11.1
MEAN		4.550	5.467
STD DEV		1.080	3.852
Cranberry			
	85/06/09	2.9	4.9
	85/06/30	2.9	2.7
	85/07/14	1.4	3.5
MINIMUM		1.4	2.7
MAXIMUM		2.9	4.9
MEAN		2.400	3.700
STD DEV		.866	1.114

LAKE	DATE	SECCHI	CHLORA
Crosby			
	85/05/12	5.5	.
	85/06/16	4.3	1.1
	85/06/23	4.3	3.0
	85/07/02	4.3	6.5
	85/08/05	4.0	5.1
	85/08/11	4.0	1.4
	85/08/25	4.0	3.1
	85/09/01	4.3	2.2
	85/09/15	3.7	8.7
MINIMUM		3.7	1.1
MAXIMUM		5.5	8.7
MEAN		4.267	3.888
STD DEV		.507	2.664
Crowe			
	85/07/01	3.0	3.3
	85/07/08	2.4	3.6
	85/07/08	2.4	2.6
	85/07/21	2.4	3.5
	85/07/29	2.4	3.1
	85/08/05	2.4	5.9
	85/09/03	2.4	7.0
MINIMUM		2.4	2.6
MAXIMUM		3.0	7.0
MEAN		2.486	4.143
STD DEV		.227	1.640
Davern			
	85/05/11	4.0	.
	85/05/20	4.6	1.1
	85/05/26	4.0	2.2
	85/06/09	4.9	1.2
	85/06/16	6.7	1.7
	85/06/23	6.7	1.5
	85/07/01	7.2	.
	85/07/07	7.2	2.7
	85/07/21	7.2	1.6
	85/08/05	6.0	1.1
	85/08/18	6.0	1.7
	85/08/25	5.2	1.4

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Davern			
	85/09/02	4.6	1.9
	85/09/08	5.2	1.9
	85/09/25	5.8	1.2
MINIMUM		4.0	1.1
MAXIMUM		7.2	2.7
MEAN		5.687	1.631
STD DEV		1.143	.468
Dempsey (Virgin)			
	85/06/03	6.3	1.1
	85/07/21	5.0	1.9
	85/08/18	4.6	3.1
	85/09/02	4.6	3.5
	85/09/15	5.5	3.4
	85/09/29	5.5	2.0
MINIMUM		4.6	1.1
MAXIMUM		6.3	3.5
MEAN		5.250	2.500
STD DEV		.653	.974
Desert (Deyos Bay)			
	85/05/20	2.7	3.3
	85/05/26	3.7	2.5
	85/06/02	4.3	3.5
	85/06/12	3.8	2.6
	85/07/01	4.3	2.9
	85/07/14	4.6	3.2
	85/07/27	4.6	2.4
	85/08/05	4.9	1.5
	85/08/18	5.5	2.2
	85/09/02	4.9	2.8
	85/09/15	4.0	2.7
	85/09/22	5.0	2.8
MINIMUM		2.7	1.5
MAXIMUM		5.5	3.5
MEAN		4.358	2.700
STD DEV		.742	.534

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Desert (South Bay)			
	85/05/12	3.2	4.8
	85/05/20	3.4	4.3
	85/06/03	4.3	4.3
	85/06/09	3.5	4.8
	85/06/16	4.3	6.1
	85/06/23	3.8	4.4
	85/07/14	5.2	2.1
	85/08/05	5.5	1.9
	85/08/11	5.0	1.5
	85/09/01	5.0	3.1
	85/09/08	3.8	3.7
	85/09/15	4.6	2.8
	85/09/22	4.9	1.4
	85/09/29	5.8	4.4
	85/10/06	4.3	1.5
	85/10/20	4.7	1.6
	85/10/27	4.3	2.5
	85/11/10	4.3	3.7
MINIMUM		3.2	1.4
MAXIMUM		5.8	6.1
MEAN		4.439	3.272
STD DEV		.724	1.422
Devil (Buce Bay)			
	85/06/03	5.6	3.7
	85/06/21	5.3	2.0
	85/07/01	5.8	2.7
	85/07/14	5.6	2.0
	85/07/28	5.5	1.6
	85/08/11	5.5	2.2
	85/09/02	5.6	2.0
	85/09/22	5.6	1.9
MINIMUM		5.3	1.6
MAXIMUM		5.8	3.7
MEAN		5.563	2.263
STD DEV		.141	.659
Devil (Hays Bay)			
	85/06/03	5.8	3.8
	85/06/21	5.2	1.6

STATISTICAL SUMMARY FOR ALL SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Devil (Hays Bay)			
	85/07/01	5.5	2.1
	85/07/14	5.5	.
	85/07/28	5.3	1.8
	85/08/11	5.2	1.9
	85/09/02	5.5	2.4
	85/09/22	5.5	2.1
MINIMUM		5.2	1.6
MAXIMUM		5.8	3.8
MEAN		5.438	2.243
STD DEV		.200	.732
Diamond			
	85/07/21	5.8	1.8
	85/08/24	6.1	.
	85/09/22	6.7	3.4
	85/10/12	4.9	1.6
MINIMUM		4.9	1.6
MAXIMUM		6.7	3.4
MEAN		5.875	2.267
STD DEV		.750	.987
Dickey (North end)			
	85/05/20	3.8	1.0
	85/06/14	3.4	2.2
	85/07/03	3.8	.
	85/07/15	3.7	2.8
	85/07/22	3.8	1.2
	85/08/07	4.5	1.9
	85/08/19	5.0	2.5
	85/08/26	4.7	2.6
	85/09/02	4.3	2.0
MINIMUM		3.4	1.0
MAXIMUM		5.0	2.8
MEAN		4.111	2.025
STD DEV		.535	.648

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Dickey (South end)			
	85/05/20	4.7	.
	85/06/14	3.9	2.5
	85/07/03	4.1	.
	85/07/08	5.1	1.7
	85/07/15	4.4	2.3
	85/07/27	4.1	1.1
	85/08/19	5.1	2.1
	85/08/26	5.4	1.8
	85/09/02	4.6	1.8
MINIMUM		3.9	1.1
MAXIMUM		5.4	2.5
MEAN		4.600	1.900
STD DEV		.522	.458
Eagle (Station 1)			
	85/06/24	6.6	4.7
	85/07/01	6.6	2.4
	85/07/08	6.6	2.1
	85/07/14	6.3	2.7
	85/07/28	5.3	2.0
	85/08/05	5.3	2.0
	85/08/11	5.3	2.5
	85/08/17	5.6	1.9
	85/08/24	5.3	2.0
	85/09/02	5.0	2.2
	85/09/07	4.7	2.6
	85/09/16	4.4	3.1
	85/09/22	4.7	2.1
MINIMUM		4.4	1.9
MAXIMUM		6.6	4.7
MEAN		5.515	2.485
STD DEV		.773	.751
Eagle (Station 2)			
	85/07/23	5.5	1.7
	85/08/05	5.6	2.6
	85/08/11	5.2	2.0
	85/08/23	4.9	1.1
	85/09/07	4.3	2.7

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
MINIMUM		4.3	1.1
MAXIMUM		5.6	2.7
MEAN		5.100	2.020
STD DEV		.524	.661
Elbow			
	85/05/05	2.6	6.8
	85/06/03	3.4	3.3
	85/06/09	3.4	2.8
	85/07/27	3.4	12.4
	85/08/06	3.4	5.5
	85/08/25	3.2	7.2
MINIMUM		2.6	2.8
MAXIMUM		3.4	12.4
MEAN		3.233	6.333
STD DEV		.320	3.469
Faraday			
	85/09/04	4.4	1.3
	85/09/08	6.7	1.3
	85/09/15	6.6	1.3
	85/09/22	6.5	1.4
	85/10/14	5.9	1.6
	85/10/30	6.4	2.4
MINIMUM		4.4	1.3
MAXIMUM		6.7	2.4
MEAN		6.083	1.550
STD DEV		.870	.432
Farren			
	85/06/02	4.7	1.5
	85/06/15	4.9	1.7
	85/07/01	5.5	2.4
	85/07/16	5.2	1.1
	85/07/31	4.9	2.1
	85/08/16	5.0	1.4
	85/09/02	4.6	1.9
	85/09/22	5.5	2.1
MINIMUM		4.6	1.1
MAXIMUM		5.5	2.4
MEAN		5.038	1.775

LAKE	DATE	SECCHI	CHLORA
STD DEV		.338	.430
Gananoque			
	85/05/16	2.6	1.9
	85/05/30	2.7	1.3
	85/06/15	2.6	4.6
	85/06/30	3.0	5.0
	85/07/21	2.7	4.7
	85/08/05	2.3	13.9
	85/08/26	2.4	14.3
	85/09/08	2.1	15.3
MINIMUM		2.1	1.3
MAXIMUM		3.0	15.3
MEAN		2.550	7.625
STD DEV		.278	5.858
Gananoque (Lost Bay)			
	85/06/15	.	2.8
	85/06/22	3.5	1.4
	85/06/29	4.1	1.1
	85/07/05	4.6	1.4
	85/07/20	3.4	2.4
	85/07/29	3.4	2.8
	85/08/03	3.7	1.5
	85/10/19	3.8	5.7
MINIMUM		3.4	1.1
MAXIMUM		4.6	5.7
MEAN		3.786	2.387
STD DEV		.438	1.498
Grippen			
	85/06/20	1.4	5.4
	85/07/15	2.0	2.9
	85/08/05	5.3	2.5
	85/08/21	3.8	4.7
	85/08/30	3.4	3.8
	85/09/11	4.1	7.6
	85/09/20	4.4	2.0
	85/10/04	4.4	4.6
MINIMUM		1.4	2.0
MAXIMUM		5.3	7.6

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
MEAN		3.600	4.188
STD DEV		1.304	1.812
Hay Bay			
	85/09/17	1.5	19.6
	85/09/25	1.0	28.7
MINIMUM		1.0	19.6
MAXIMUM		1.5	28.7
MEAN		1.250	24.150
STD DEV		.354	6.435
Indian			
	85/05/29	4.6	1.5
	85/06/06	3.8	2.1
	85/06/18	4.4	4.2
	85/06/28	4.0	2.5
	85/07/03	4.3	3.4
	85/07/10	4.0	1.6
	85/07/18	4.6	12.1
	85/07/25	3.8	2.1
	85/08/08	5.0	2.6
	85/08/14	5.2	3.4
	85/08/20	4.0	3.1
	85/09/03	3.8	4.1
	85/09/12	4.0	3.5
MINIMUM		3.8	1.5
MAXIMUM		5.2	12.1
MEAN		4.269	3.554
STD DEV		.464	2.713
Jeffrey			
	85/07/17	6.6	1.8
	85/07/28	5.1	2.2
	85/08/11	7.3	1.4
	85/08/18	6.7	1.4
	85/09/01	7.0	1.4
	85/09/07	8.2	1.6
	85/09/22	6.4	3.0
	85/10/14	8.5	1.2
MINIMUM		5.1	1.2
MAXIMUM		8.5	3.0

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
MEAN		6.975	1.750
STD DEV		1.069	.593
Joeperry			
	85/06/20	2.7	1.6
	85/06/27	2.4	3.5
	85/07/04	2.4	2.6
	85/07/11	2.4	2.2
	85/07/18	3.4	5.1
	85/07/25	2.4	2.1
	85/08/01	2.4	2.7
	85/08/08	6.1	2.4
	85/08/22	2.1	3.2
	85/08/29	2.1	3.3
MINIMUM		2.1	1.6
MAXIMUM		6.1	5.1
MEAN		2.840	2.870
STD DEV		1.203	.980
Killenbeck			
	85/06/03	3.0	4.0
	85/06/10	3.4	4.8
	85/06/17	2.7	5.3
	85/06/24	3.0	8.5
	85/07/02	3.0	5.1
	85/07/08	3.0	9.4
	85/07/15	2.7	1.6
	85/07/22	3.0	11.3
	85/07/29	2.7	7.5
	85/08/06	3.1	4.6
	85/08/20	2.7	9.2
	85/08/26	2.4	8.4
	85/09/03	3.0	6.0
	85/09/09	3.1	6.1
	85/09/16	3.7	5.2
	85/09/30	4.8	3.3
	85/10/07	3.4	3.6
MINIMUM		2.4	1.6
MAXIMUM		4.8	11.3
MEAN		3.100	6.112
STD DEV		.537	2.570

LAKE	DATE	SECCHI	CHLORA
Limerick			
	85/05/24	3.7	1.6
	85/07/02	4.6	2.1
	85/07/08	5.5	3.0
	85/07/17	5.5	5.0
	85/07/24	4.9	1.9
	85/08/08	4.0	1.5
	85/08/18	4.3	1.3
	85/08/29	4.3	1.4
	85/09/5	4.3	2.2
MINIMUM		3.7	1.3
MAXIMUM		5.5	5.0
MEAN		4.567	2.222
STD DEV		.626	1.166
Little Cranberry			
	85/06/27	1.8	3.6
	85/07/25	1.8	5.9
	85/08/22	1.7	17.6
MINIMUM		1.7	3.6
MAXIMUM		1.8	17.6
MEAN		1.767	9.033
STD DEV		.058	7.508
Little Silver (Basin B)			
	85/05/12	3.5	1.3
	85/05/26	3.4	4.6
	85/06/09	3.4	5.5
	85/06/22	3.8	2.4
	85/07/01	4.6	2.4
	85/07/07	4.0	2.7
	85/07/14	4.0	1.2
	85/07/21	4.0	1.7
	85/08/05	4.6	2.1
	85/08/11	4.0	3.0
	85/08/18	4.3	3.7
	85/09/02	6.6	7.3
	85/09/07	3.4	8.6
	85/09/15	3.1	9.0
	85/09/22	2.7	6.7
	85/10/20	2.7	4.2

LAKE	DATE	SECCHI	CHLORA
MINIMUM		2.7	1.2
MAXIMUM		6.6	9.0
MEAN		3.881	4.150
STD DEV		.928	2.563
Little Silver (T.R.Bay)			
	85/05/12	3.5	1.0
	85/05/26	3.8	2.4
	85/06/09	4.0	3.3
	85/06/22	4.1	2.3
	85/07/01	4.9	2.3
	85/07/07	4.3	2.0
	85/07/14	4.0	.
	85/07/21	4.3	1.5
	85/08/05	4.3	2.2
	85/08/11	4.8	1.7
	85/08/18	4.9	3.7
	85/09/02	6.4	5.6
	85/09/07	3.4	5.4
	85/09/15	2.7	7.7
	85/09/22	2.7	7.9
	85/10/20	2.4	4.4
MINIMUM		2.4	1.0
MAXIMUM		6.4	7.9
MEAN		4.031	3.560
STD DEV		.996	2.194
Loughborough (E. Basin)			
	85/06/24	2.6	6.6
	85/07/03	3.0	4.1
	85/07/10	3.4	3.5
	85/07/17	2.7	7.3
	85/07/24	2.4	5.1
	85/07/31	2.4	5.2
	85/08/08	2.6	5.7
	85/08/15	2.4	6.5
	85/08/22	2.4	8.9
	85/08/29	2.0	10.0
	85/09/05	2.4	7.2
	85/09/12	2.4	8.5
	85/09/29	2.8	4.8
	85/10/06	2.4	7.3
	85/10/14	3.5	5.3
	85/10/21	.	5.8
MINIMUM		2.0	3.5

LAKE	DATE	SECCHI	CHLORA
MAXIMUM		3.5	10.0
MEAN		2.627	6.363
STD DEV		.404	1.777
Loughborough (W. Basin)			
	85/08/12	6.0	5.0
	85/09/02	5.2	3.2
	85/09/17	8.2	1.9
	85/09/22	5.3	1.0
MINIMUM		5.2	1.0
MAXIMUM		8.2	5.0
MEAN		6.175	2.775
STD DEV		1.396	1.737
Lower Beverley			
	85/05/20	1.5	5.8
	85/06/09	1.5	8.7
	85/07/02	2.3	4.9
	85/07/18	2.1	3.3
	85/08/05	1.4	12.3
	85/08/23	1.4	20.1
	85/09/02	1.7	29.5
	85/09/22	1.5	23.8
MINIMUM		1.4	3.3
MAXIMUM		2.3	29.5
MEAN		1.675	13.550
STD DEV		.341	9.764
Mazinaw			
	85/06/20	3.0	1.0
	85/06/27	2.7	1.3
	85/07/04	2.7	1.4
	85/07/11	2.4	1.0
	85/07/17	4.4	2.7
	85/07/18	3.4	.
	85/07/25	2.4	.
	85/08/01	2.4	.
	85/08/08	6.1	1.2
	85/08/21	4.7	1.5
	85/08/22	2.7	1.8
	85/08/27	4.9	.
	85/08/27	4.9	1.6

LAKE	DATE	SECCHI	CHLORA
Mazinaw			
	85/08/29	2.4	1.8
	85/10/14	4.9	2.9
MINIMUM		2.4	1.0
MAXIMUM		6.1	2.9
MEAN		3.600	1.655
STD DEV		1.247	.630
Mississippi			
	85/06/17	3.7	2.6
	85/07/01	3.0	1.4
	85/07/14	3.7	6.4
	85/07/31	2.7	.
	85/08/19	3.7	2.0
	85/08/26	3.7	1.3
	85/09/03	3.0	7.7
	85/09/10	2.9	7.9
MINIMUM		2.7	1.3
MAXIMUM		3.7	7.9
MEAN		3.300	4.186
STD DEV		.438	3.012
Moira			
	85/06/02	3.8	2.6
	85/06/09	3.0	5.4
	85/06/23	2.3	7.5
	85/07/01	2.1	9.4
	85/07/08	2.2	11.3
	85/07/15	1.8	2.3
	85/07/22	1.9	10.5
	85/07/28	1.6	10.8
	85/08/04	1.7	7.4
	85/08/12	1.7	17.9
	85/08/21	1.4	30.7
	85/08/27	1.1	42.7
	85/09/08	1.4	24.8
	85/09/15	1.4	22.9
MINIMUM		1.1	2.3
MAXIMUM		3.8	42.7
MEAN		1.957	14.729

LAKE	DATE	SECCHI	CHLORA
STD DEV		.714	11.714
Mosque			
	85/06/30	5.3	2.0
	85/06/30	6.1	1.1
	85/07/20	5.2	.
	85/07/20	5.5	.9
	85/08/04	4.9	1.0
	85/08/04	4.9	.
	85/08/18	4.7	2.0
	85/08/18	4.9	1.6
	85/09/01	4.3	2.0
	85/09/01	4.3	2.2
	85/09/14	4.6	2.2
	85/09/14	4.3	2.1
	85/10/13	4.9	2.0
	85/10/13	4.9	1.9
MINIMUM		4.3	.9
MAXIMUM		6.1	2.2
MEAN		4.914	1.750
STD DEV		.501	.480
Mosque (N.W. Basin)			
	85/06/30	3.8	2.8
	85/07/20	4.3	1.9
	85/08/04	3.7	2.1
	85/08/18	3.7	4.0
	85/09/01	3.4	4.0
	85/09/14	3.1	3.9
	85/10/13	4.0	3.2
MINIMUM		3.1	1.9
MAXIMUM		4.3	4.0
MEAN		3.714	3.129
STD DEV		.389	.894
Muskrat			
	85/07/18	4.6	4.4
	85/07/30	4.9	1.8
	85/08/08	4.4	2.8
	85/08/16	5.0	3.4
	85/08/23	4.4	2.5
	85/09/06	3.0	5.9

LAKE	DATE	SECCHI	CHLORA
MINIMUM		3.0	1.8
MAXIMUM		5.0	5.9
MEAN		4.383	3.467
STD DEV		.722	1.480
Norway			
	85/07/01	5.2	1.7
	85/07/21	4.7	1.5
	85/08/04	5.8	1.2
	85/10/12	4.9	1.5
MINIMUM		4.7	1.2
MAXIMUM		5.8	1.7
MEAN		5.150	1.475
STD DEV		.480	.206
Olmstead			
	85/09/18	7.0	1.6
	85/10/01	6.4	3.5
	85/10/29	4.3	9.0
	85/11/18	3.7	9.0
MINIMUM		3.7	1.6
MAXIMUM		7.0	9.0
MEAN		5.350	5.775
STD DEV		1.597	3.804
Opinicon			
	85/06/02	3.0	4.9
	85/06/10	2.9	3.6
	85/06/19	2.9	4.3
	85/06/25	3.0	4.7
	85/07/02	3.2	3.8
	85/07/08	4.0	2.9
	85/07/15	3.0	1.5
	85/07/22	3.2	2.6
	85/07/29	2.4	3.9
	85/08/05	2.4	3.3
	85/08/11	2.9	3.2
	85/08/19	2.3	6.4
	85/08/27	2.6	4.7
	85/09/02	2.6	5.1
	85/09/08	2.9	3.0

LAKE	DATE	SECCHI	CHLORA
Opinicon			
	85/09/15	3.5	2.2
	85/09/22	4.1	3.0
	85/09/29	3.8	3.4
	85/10/12	3.5	5.3
MINIMUM		2.3	1.5
MAXIMUM		4.1	6.4
MEAN		3.063	3.779
STD DEV		.523	1.201
Otter			
	85/06/08	2.7	2.0
	85/06/15	3.0	2.2
	85/06/23	2.7	1.6
	85/07/02	3.0	1.9
	85/07/13	3.4	3.0
	85/07/23	3.4	2.0
	85/08/04	3.1	1.3
	85/08/10	3.0	1.6
	85/08/31	2.7	2.4
	85/09/14	3.1	2.9
	85/09/22	2.9	2.9
	85/09/29	2.8	3.7
MINIMUM		2.7	1.3
MAXIMUM		3.4	3.7
MEAN		2.983	2.292
STD DEV		.244	.708
Otty (Site A)			
	85/06/10	4.9	1.9
	85/06/24	5.2	1.9
	85/07/02	5.2	2.4
	85/07/08	5.8	2.4
	85/07/15	5.5	1.0
	85/07/22	4.6	2.9
	85/07/29	4.6	2.2
	85/08/06	3.7	1.9
	85/08/12	4.0	3.3
	85/08/16	.	3.0
	85/08/19	4.0	2.8
	85/09/03	4.0	3.3

LAKE	DATE	SECCHI	CHLORA
MINIMUM		3.7	1.0
MAXIMUM		5.8	3.3
MEAN		4.682	2.417
STD DEV		.698	.683
Otty (Site B)			
	85/06/10	5.5	2.5
	85/06/24	5.2	2.1
	85/07/02	5.2	2.3
	85/07/08	5.8	2.4
	85/07/15	5.2	1.7
	85/07/22	4.6	2.9
	85/07/29	4.3	2.2
	85/08/06	3.7	2.3
	85/08/12	4.0	2.9
	85/08/19	4.0	3.0
	85/08/26	.	3.5
	85/09/03	4.0	3.4
MINIMUM		3.7	1.7
MAXIMUM		5.8	3.5
MEAN		4.682	2.600
STD DEV		.724	.543
Papineau			
	85/07/02	7.0	.
	85/07/18	9.3	5.6
	85/07/30	8.1	1.4
	85/08/11	6.9	1.8
	85/08/21	7.5	1.3
MINIMUM		6.9	1.3
MAXIMUM		9.3	5.6
MEAN		7.760	2.525
STD DEV		.984	2.061
Paugh			
	85/07/01	5.5	.
	85/07/29	5.7	1.2
	85/08/05	4.9	1.4
	85/09/02	5.3	1.5
	85/09/15	6.1	1.1
	85/09/30	5.0	1.9

LAKE	DATE	SECCHI	CHLORA
Paugh			
	85/10/14	6.1	.
MINIMUM		4.9	1.1
MAXIMUM		6.1	1.9
MEAN		5.514	1.420
STD DEV		.485	.311
Pike			
	85/06/02	2.7	5.6
	85/07/01	3.4	3.3
	85/07/21	2.4	1.5
	85/07/28	2.3	6.8
	85/08/17	2.1	4.2
	85/09/02	2.9	6.9
	85/09/22	2.6	3.0
	85/10/14	2.4	12.4
MINIMUM		2.1	1.5
MAXIMUM		3.4	12.4
MEAN		2.600	5.463
STD DEV		.407	3.381
Red Horse (East Basin)			
	85/08/19	2.4	6.4
	85/08/23	2.6	3.9
	85/08/27	3.4	3.9
	85/09/01	4.6	3.4
	85/09/07	3.7	2.6
	85/09/14	4.3	3.0
	85/09/21	3.7	4.9
	85/09/22	4.1	4.5
	85/10/05	3.0	5.7
	85/10/12	3.8	3.0
	85/10/19	3.7	3.7
	85/10/26	4.1	4.2
	85/11/02	4.3	3.5
	85/11/09	4.9	2.8
MINIMUM		2.4	2.6
MAXIMUM		4.9	6.4
MEAN		3.757	3.964
STD DEV		.720	1.104

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Red Horse (West Basin)			
	85/06/01	3.7	2.9
	85/06/16	3.8	6.5
	85/07/01	3.7	5.5
	85/07/08	3.0	4.1
	85/07/18	2.4	5.0
	85/07/28	2.7	3.2
	85/08/06	2.9	7.5
	85/08/11	2.4	3.4
	85/08/18	2.4	7.0
	85/08/27	3.3	5.6
	85/09/02	3.7	4.6
	85/09/11	3.7	9.2
	85/09/22	3.8	6.9
	85/10/05	3.1	.
	85/10/14	4.0	7.0
MINIMUM		2.4	2.9
MAXIMUM		4.0	9.2
MEAN		3.240	5.600
STD DEV		.577	1.850
Saint Andrew			
	85/07/01	4.7	1.9
	85/07/07	3.2	2.7
	85/07/14	2.9	1.7
	85/07/21	3.0	3.4
	85/07/28	2.9	3.8
	85/08/04	3.2	2.4
	85/08/11	3.2	1.8
	85/08/18	3.2	2.8
	85/08/25	3.2	3.6
	85/09/01	3.5	2.8
	85/09/14	3.8	3.4
MINIMUM		2.9	1.7
MAXIMUM		4.7	3.8
MEAN		3.345	2.755
STD DEV		.518	.743
Saint Peter			
	85/07/02	3.7	1.8
	85/08/03	4.0	1.2

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Saint Peter			
	85/08/08	4.0	1.3
	85/09/02	4.1	1.5
MINIMUM		3.7	1.2
MAXIMUM		4.1	1.8
MEAN		3.950	1.450
STD DEV		.173	.265
Salmon Trout			
	85/07/01	4.3	3.4
	85/07/14	4.0	.
	85/07/30	4.3	7.5
	85/08/11	3.4	10.7
	85/09/02	2.4	10.4
	85/09/15	2.4	12.8
	85/10/14	2.1	14.0
MINIMUM		2.1	3.4
MAXIMUM		4.3	14.0
MEAN		3.271	9.800
STD DEV		.962	3.849
Sand			
	85/05/21	3.4	.
	85/05/30	3.9	1.1
	85/06/11	3.0	3.2
	85/06/20	3.2	6.1
	85/06/27	4.3	3.0
	85/07/02	4.0	3.7
	85/07/11	4.0	2.4
	85/07/17	4.6	2.8
	85/07/28	2.7	2.4
	85/08/21	3.7	4.2
	85/08/28	3.0	8.8
	85/09/02	2.4	8.1
	85/09/10	.	5.7
	85/09/16	2.9	9.1
	85/09/25	3.7	3.6
	85/09/30	3.1	3.8
	85/10/07	3.4	7.9
	85/10/14	3.0	6.8
	85/10/22	3.0	7.6

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Sand			
	85/10/27	3.4	6.4
MINIMUM		2.4	1.1
MAXIMUM		4.6	9.1
MEAN		3.405	5.089
STD DEV		.573	2.464
Shabomeka			
	85/07/03	4.1	3.0
	85/07/14	3.5	1.7
	85/07/18	4.8	.
	85/07/25	3.5	1.6
	85/08/01	4.0	2.9
	85/08/09	4.8	2.1
	85/08/16	4.5	1.5
	85/08/22	4.0	2.6
	85/08/29	5.0	3.5
	85/09/09	4.0	3.5
	85/09/12	4.5	3.4
	85/09/20	4.5	2.1
MINIMUM		3.5	1.5
MAXIMUM		5.0	3.5
MEAN		4.267	2.536
STD DEV		.494	.774
Sharbot			
	85/05/27	4.3	2.6
	85/06/04	4.6	3.3
	85/06/18	5.5	2.7
	85/07/02	4.6	2.0
	85/07/16	4.0	2.0
	85/07/30	5.2	3.4
	85/08/13	4.6	3.0
	85/08/27	3.7	3.0
	85/09/10	4.0	3.1
	85/09/24	4.0	1.9
MINIMUM		3.7	1.9
MAXIMUM		5.5	3.4
MEAN		4.450	2.700
STD DEV		.570	.560

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
Silver			
	85/06/04	4.9	1.4
	85/06/25	3.7	2.1
	85/07/03	3.4	2.1
	85/07/14	3.0	3.6
	85/07/20	3.3	2.6
	85/07/29	3.0	1.5
	85/08/07	3.6	1.7
	85/08/28	3.0	3.0
	85/09/03	3.9	2.3
	85/09/11	4.3	2.9
	85/09/18	4.6	2.5
MINIMUM		3.0	1.4
MAXIMUM		4.9	3.6
MEAN		3.700	2.336
STD DEV		.662	.674
Skootamatta			
	85/07/09	2.9	2.5
	85/07/16	2.6	2.4
	85/07/23	3.2	2.1
	85/07/30	3.8	1.2
	85/08/11	3.8	2.5
	85/09/10	3.5	2.7
	85/09/10	4.0	2.2
	85/09/10	3.8	2.4
	85/09/10	3.8	2.1
	85/09/10	3.5	2.3
	85/09/10	3.5	2.5
MINIMUM		2.6	1.2
MAXIMUM		4.0	2.7
MEAN		3.491	2.264
STD DEV		.432	.398
Steenburg			
	85/05/23	4.0	2.9
	85/06/23	4.3	3.1
	85/06/23	4.3	3.2
MINIMUM		4.0	2.9
MAXIMUM		4.3	3.2

LAKE	DATE	SECCHI	CHLORA
MEAN		4.200	3.067
STD DEV		.173	.153
Stoco (North Basin)			
	85/05/01	.8	1.1
	85/05/08	2.6	.
	85/05/15	2.3	1.9
	85/05/21	2.3	2.4
	85/05/29	2.6	2.8
	85/06/06	2.3	2.5
	85/06/27	2.3	5.3
	85/07/02	2.0	5.7
	85/07/09	1.7	9.0
	85/07/17	1.7	16.6
	85/07/24	1.2	7.6
	85/07/30	1.1	10.0
	85/08/09	1.1	15.0
	85/08/14	1.0	24.4
	85/08/21	.7	26.1
	85/09/03	.7	.
	85/09/11	1.1	11.9
	85/09/16	1.4	17.6
MINIMUM		.7	1.1
MAXIMUM		2.6	26.1
MEAN		1.606	9.994
STD DEV		.673	7.977
Stoco (South Basin)			
	85/05/01	.6	1.6
	85/05/08	2.0	.
	85/05/15	2.0	1.7
	85/05/21	2.6	2.6
	85/05/29	2.3	3.0
	85/06/06	2.0	5.0
	85/06/27	2.3	5.8
	85/07/02	1.7	8.1
	85/07/09	1.7	8.3
	85/07/17	1.1	14.7
	85/07/24	1.3	7.6
	85/07/30	1.1	12.7
	85/08/09	1.1	19.3
	85/08/14	1.0	18.8
	85/08/21	1.0	21.9
	85/09/03	.7	46.2
	85/09/11	1.1	7.6
	85/09/16	1.1	17.8

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

LAKE	DATE	SECCHI	CHLORA
MINIMUM		.6	1.6
MAXIMUM		2.6	46.2
MEAN		1.483	11.924
STD DEV		.599	11.032
Thirteen Island			
	85/05/26	3.7	2.5
	85/06/09	3.4	2.5
	85/06/16	4.3	3.9
	85/06/23	3.4	4.5
	85/07/01	3.7	2.0
	85/07/07	4.0	2.8
	85/07/14	3.7	2.8
	85/07/22	3.7	3.7
	85/08/05	3.1	3.8
	85/08/11	3.0	3.7
	85/08/18	3.0	3.7
	85/08/25	3.4	5.2
	85/09/02	3.4	5.1
	85/09/07	3.4	4.7
	85/09/22	3.7	4.2
	85/09/29	.	3.9
MINIMUM		3.0	2.0
MAXIMUM		4.3	5.2
MEAN		3.527	3.688
STD DEV		.358	.951
Troy			
	85/05/12	4.6	1.6
	85/05/20	3.7	2.5
	85/05/26	3.4	3.0
	85/06/02	2.7	4.1
	85/06/09	3.1	3.3
	85/07/01	2.9	5.7
	85/07/07	3.1	5.8
	85/07/14	2.6	2.1
	85/07/21	2.9	3.7
	85/07/28	2.1	8.6
	85/08/05	1.8	16.9
	85/08/11	1.6	22.1
	85/08/18	1.5	12.6
	85/09/02	1.5	20.7
	85/09/08	1.5	15.4
MINIMUM		1.5	1.6
MAXIMUM		4.6	22.1
MEAN		2.600	8.540

LAKE	DATE	SECCHI	CHLORA
STD DEV		.928	7.112
Twin Sister (East Basin)			
	85/05/29	3.5	2.7
	85/06/09	3.4	3.1
	85/06/23	3.7	7.3
	85/07/01	4.0	5.5
	85/07/14	3.4	1.6
	85/08/11	3.5	4.6
	85/08/25	3.7	5.4
	85/09/22	3.7	9.3
	85/09/27	4.0	4.0
	85/10/10	3.4	3.3
MINIMUM		3.4	1.6
MAXIMUM		4.0	9.3
MEAN		3.630	4.680
STD DEV		.231	2.302
Twin Sister (West Basin)			
	85/05/20	3.4	4.3
	85/07/02	3.5	3.3
	85/07/21	3.5	32.4
	85/08/05	4.4	6.7
	85/08/14	4.0	8.8
	85/08/20	3.7	6.6
	85/09/02	3.7	6.0
	85/10/14	4.4	1.7
MINIMUM		3.4	1.7
MAXIMUM		4.4	32.4
MEAN		3.825	8.725
STD DEV		.399	9.819
West			
	85/07/13	3.0	10.8
	85/07/13	3.7	10.0
	85/07/27	3.7	8.0
	85/07/27	3.7	7.1
	85/08/05	3.7	7.6
	85/08/05	3.7	7.6
	85/08/10	3.7	7.5
	85/08/10	3.5	6.4
	85/08/26	3.7	7.6

STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

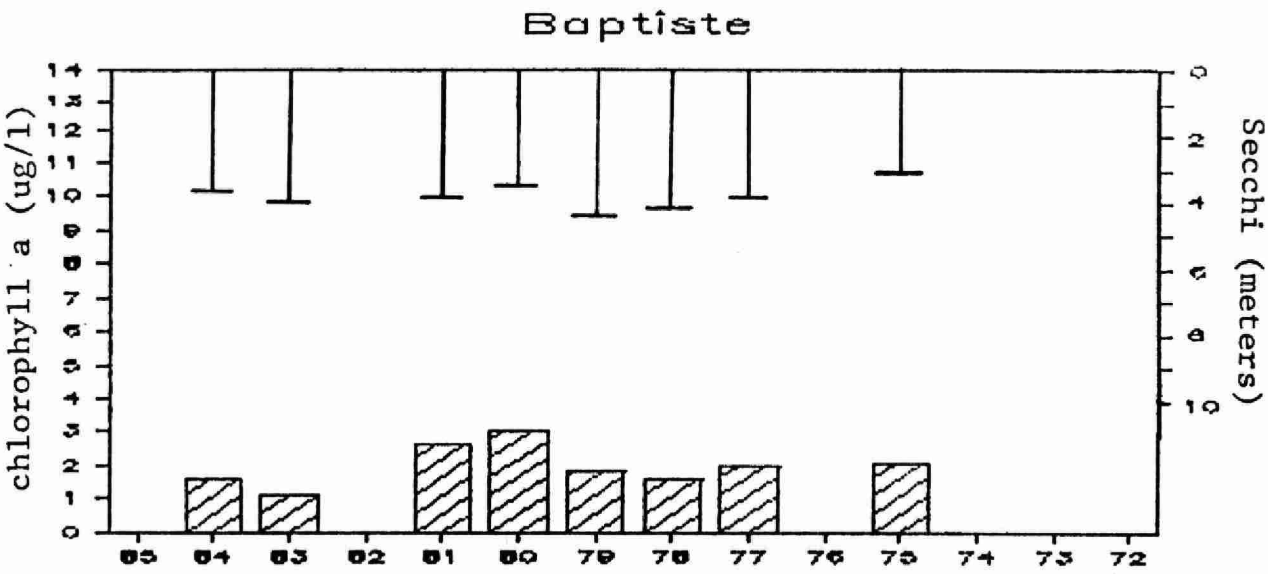
LAKE	DATE	SECCHI	CHLORA
West			
	85/08/26	3.7	7.6
	85/09/02	3.4	7.8
	85/09/02	3.4	7.4
MINIMUM		3.0	6.4
MAXIMUM		3.7	10.8
MEAN		3.575	7.950
STD DEV		.218	1.224
White (Station 1)			
	85/05/08	2.4	1.7
	85/05/15	3.0	2.5
	85/05/21	3.0	1.3
	85/06/06	3.7	2.7
	85/06/12	3.4	3.5
	85/06/20	2.6	4.6
	85/06/26	2.4	5.2
	85/07/03	2.4	4.8
	85/07/10	2.6	3.3
	85/07/17	1.8	6.3
	85/07/24	1.7	3.4
	85/08/08	2.3	7.4
	85/08/14	1.8	9.3
	85/08/21	1.5	18.9
	85/08/28	1.2	22.5
	85/09/04	1.4	17.8
	85/09/11	1.4	14.9
	85/09/18	1.8	11.7
	85/09/25	1.8	5.2
	85/10/02	2.3	7.8
	85/10/09	2.4	8.8
	85/10/16	3.0	4.9
	85/10/23	3.8	4.6
	85/10/30	3.8	2.4
MINIMUM		1.2	1.3
MAXIMUM		3.8	22.5
MEAN		2.396	7.313
STD DEV		.779	5.813
White (Station 2)			
	85/05/08	2.4	2.0

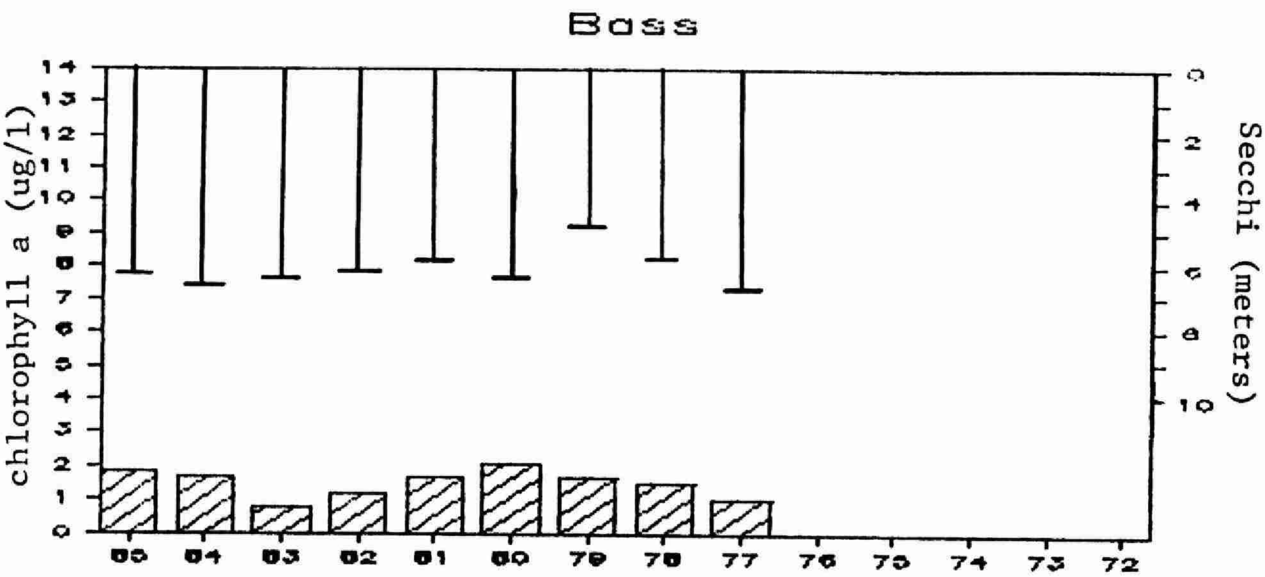
STATISTICAL SUMMARY FOR ALL
SELF-HELP RECREATIONAL LAKES

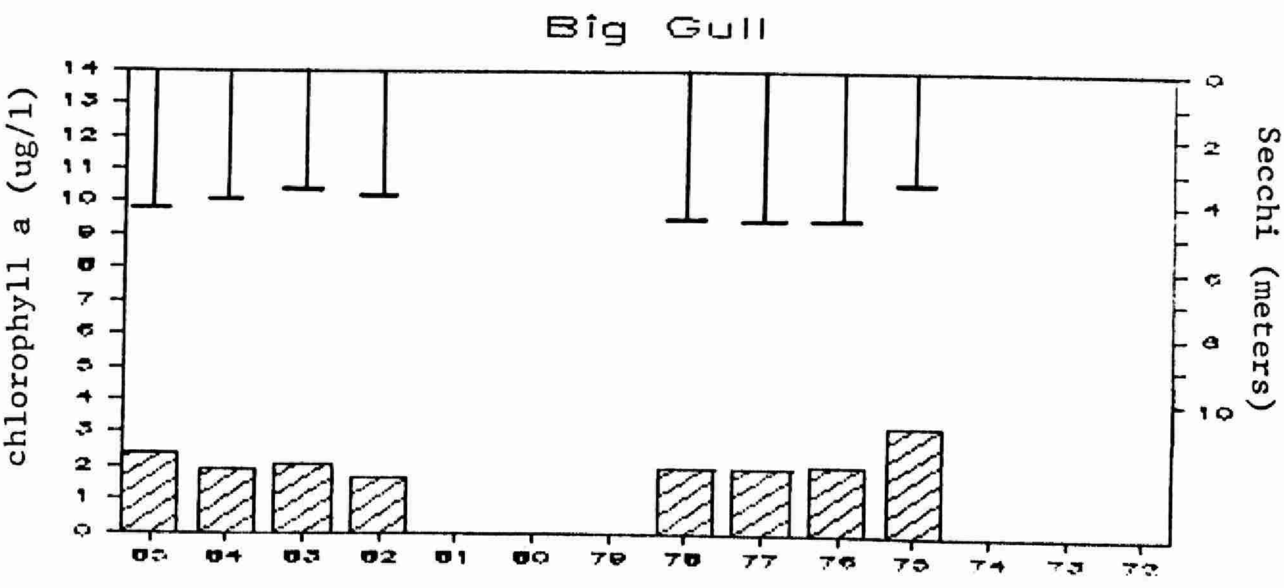
LAKE	DATE	SECCHI	CHLORA
White (Station 2)			
	85/05/15	3.0	3.1
	85/05/21	3.0	3.0
	85/06/06	4.0	2.7
	85/06/12	3.5	3.2
	85/06/20	2.9	.
	85/06/26	2.4	5.3
	85/07/03	2.4	3.9
	85/07/10	2.4	3.8
	85/07/17	2.4	10.8
	85/07/24	2.0	2.5
	85/08/08	2.3	.
	85/08/14	2.0	10.9
	85/08/21	1.5	21.5
	85/08/28	1.2	28.3
	85/09/04	1.4	19.0
	85/09/11	1.7	11.8
	85/09/18	2.0	.
	85/09/25	2.0	6.7
	85/10/02	1.8	7.1
	85/10/09	2.4	11.9
	85/10/16	2.7	6.8
	85/10/23	3.4	4.6
	85/10/30	4.0	4.7
MINIMUM		1.2	2.0
MAXIMUM		4.0	28.3
MEAN		2.450	8.267
STD DEV		.754	7.051

Appendix 2

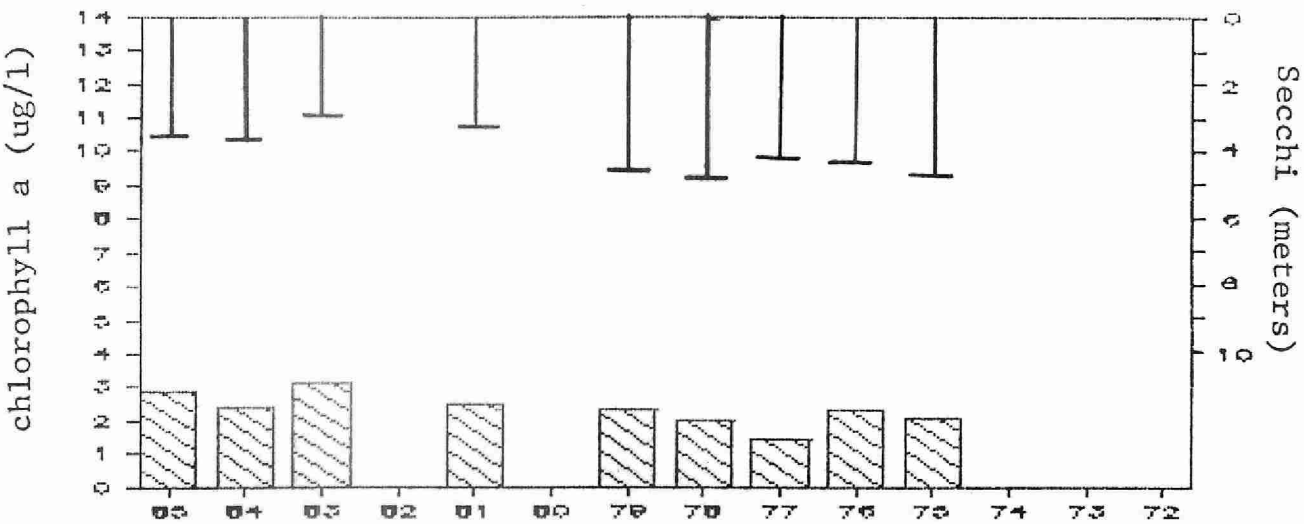
Summary for mean chlorophyll and mean Secchi disc results for 1985 and past years with six or more sets of measurements for lakes in the 1985 Southeastern Region Self Help Program


Baptiste
chlorophyll a (ug/1)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

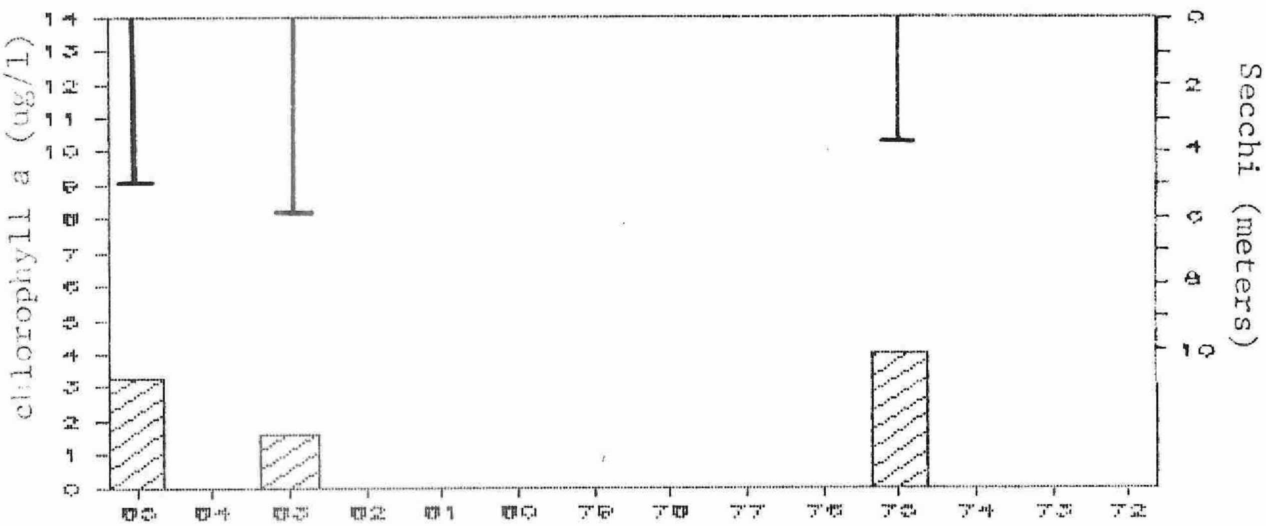

Bass
chlorophyll a (ug/1)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72


Big Gull
chlorophyll a (ug/1)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

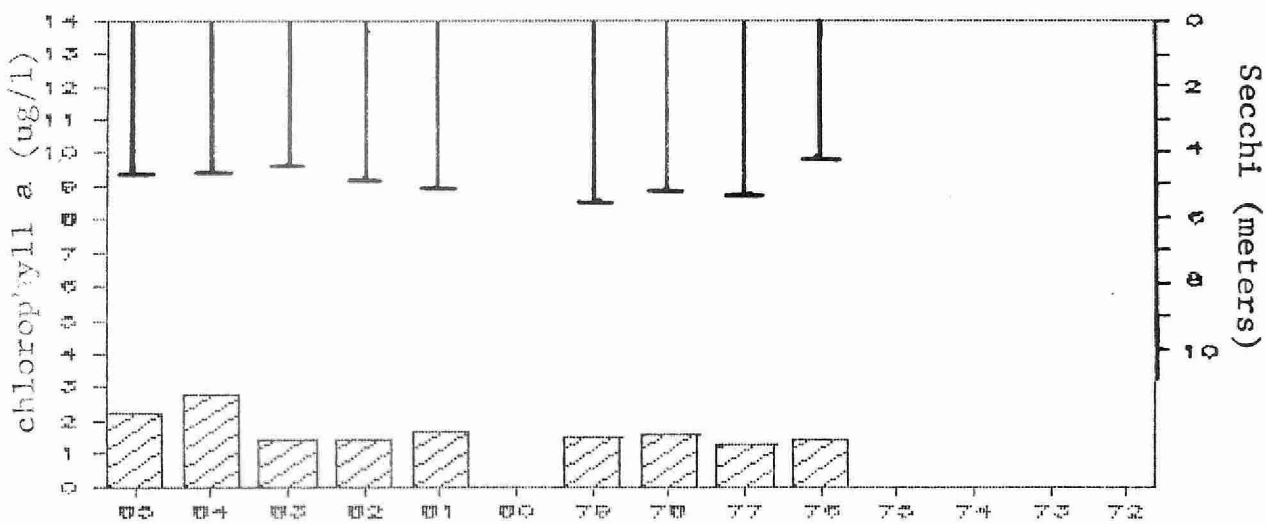
Big Rideau

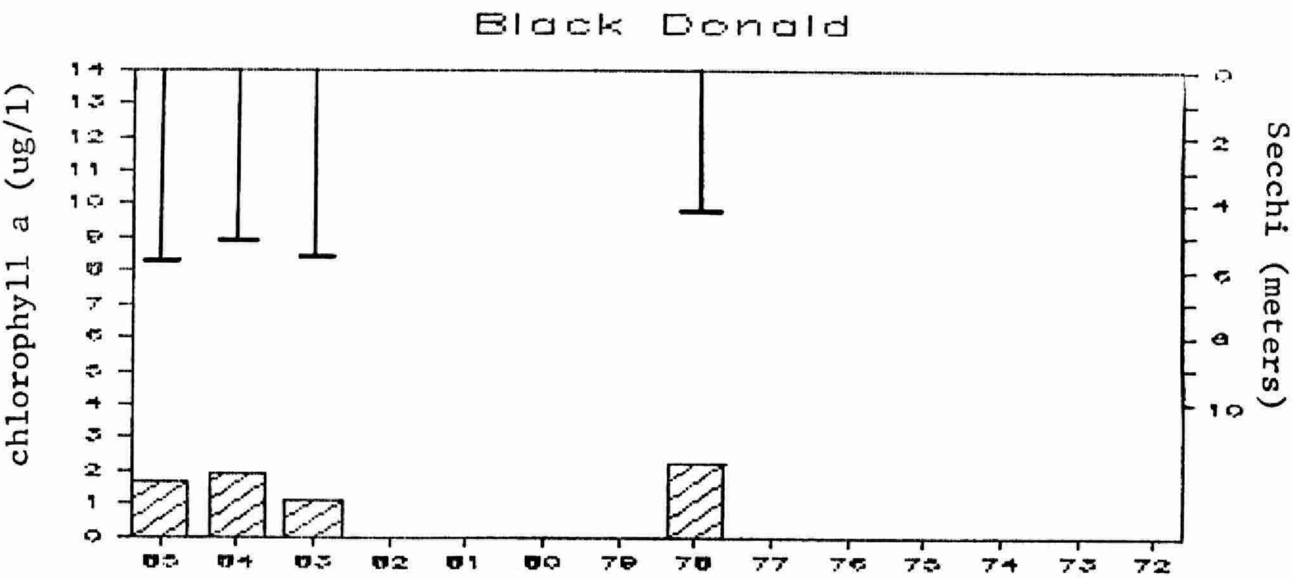


Black (North Burgess Twp)

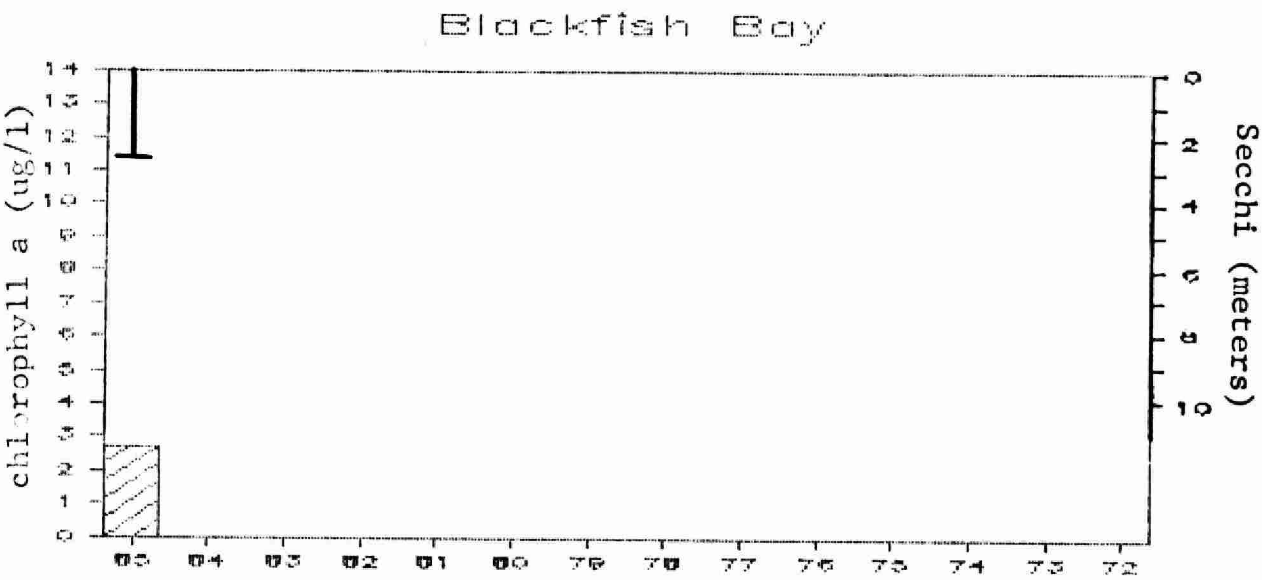


Black (Olden Twp)

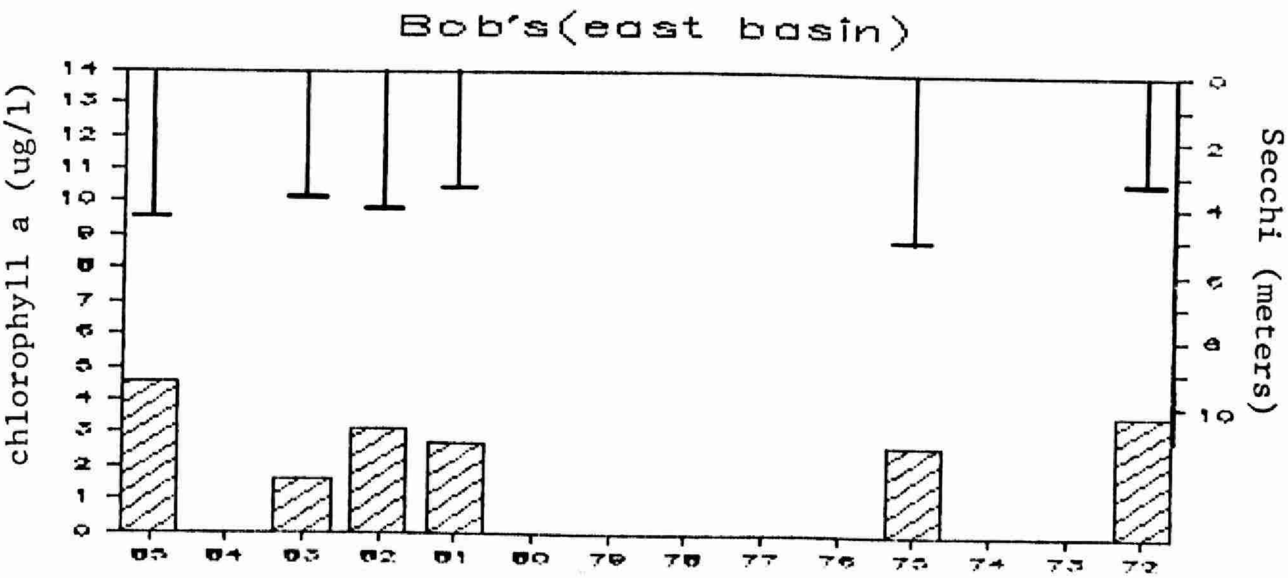




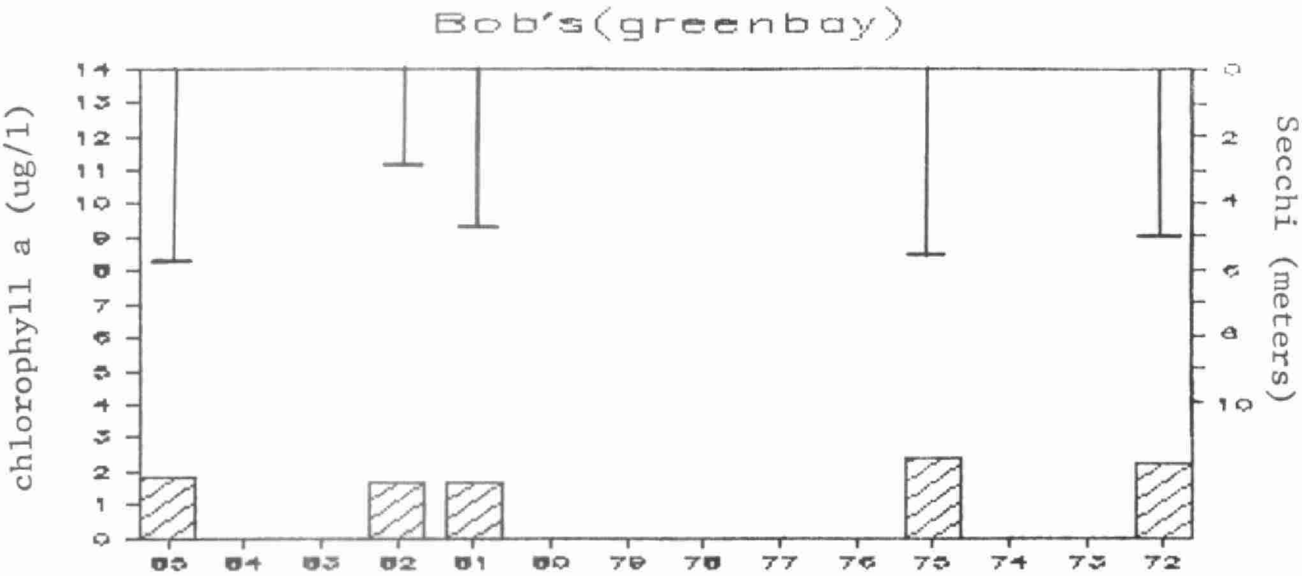
Black Donald
chlorophyll a (ug/1)
Secchi (meters)
14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72

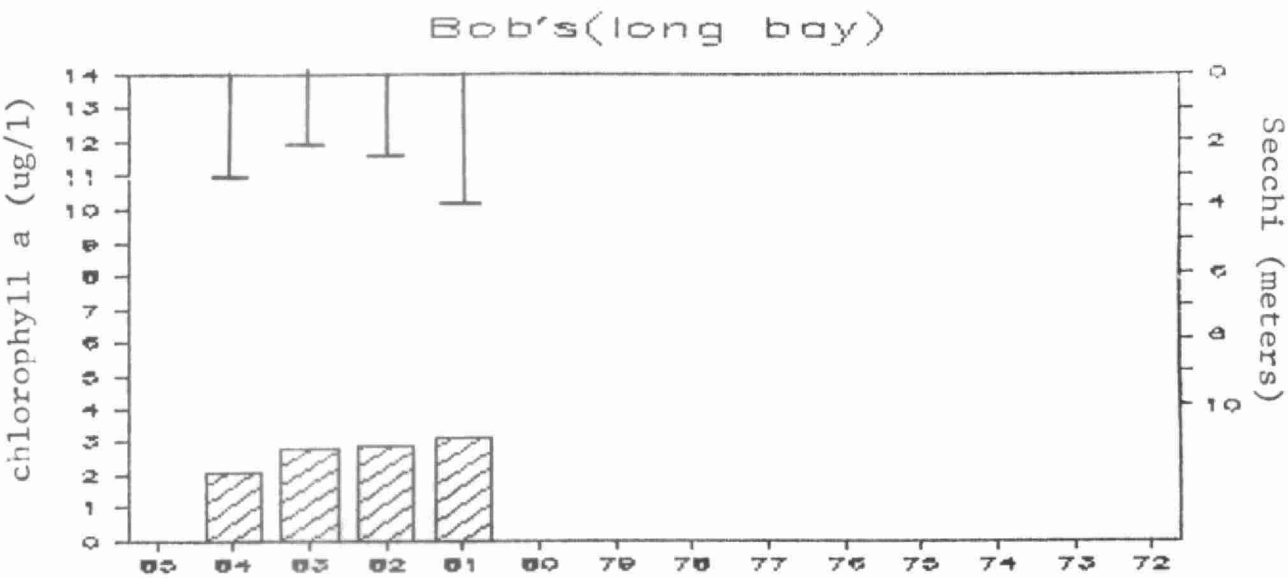


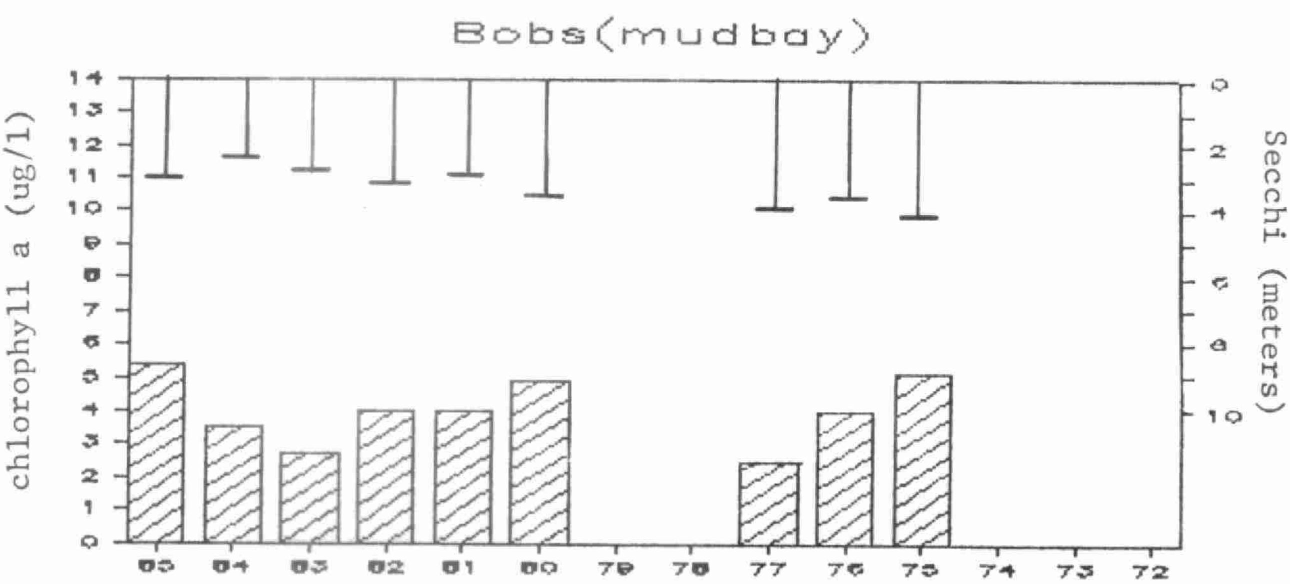
Blackfish Bay
chlorophyll a (ug/1)
Secchi (meters)
14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72



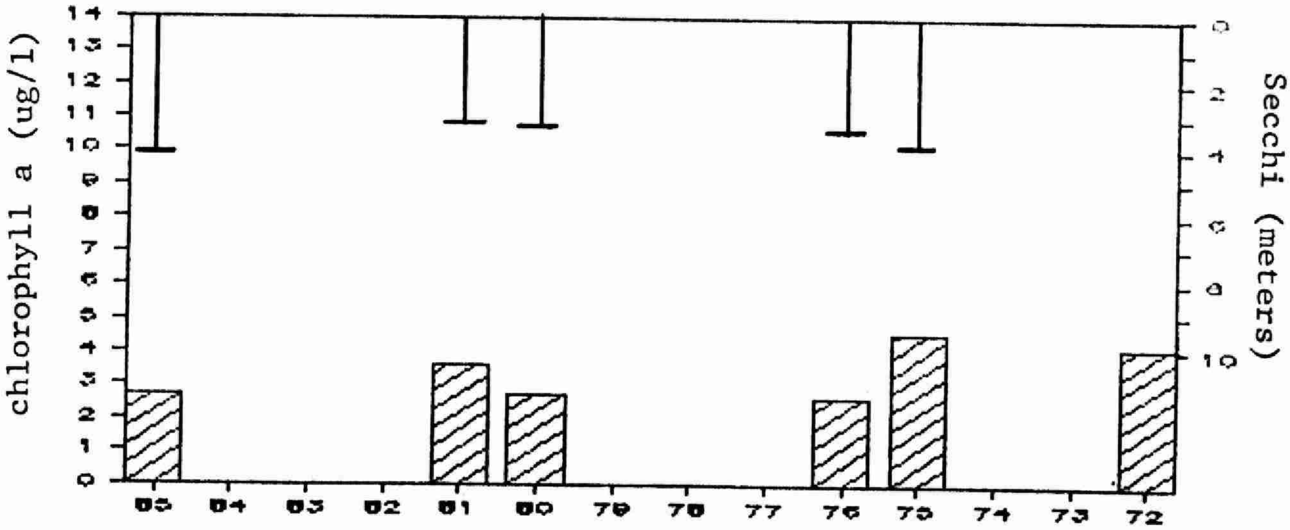
Bob's(east basin)
chlorophyll a (ug/1)
Secchi (meters)
14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72


Bob's(greenbay)
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

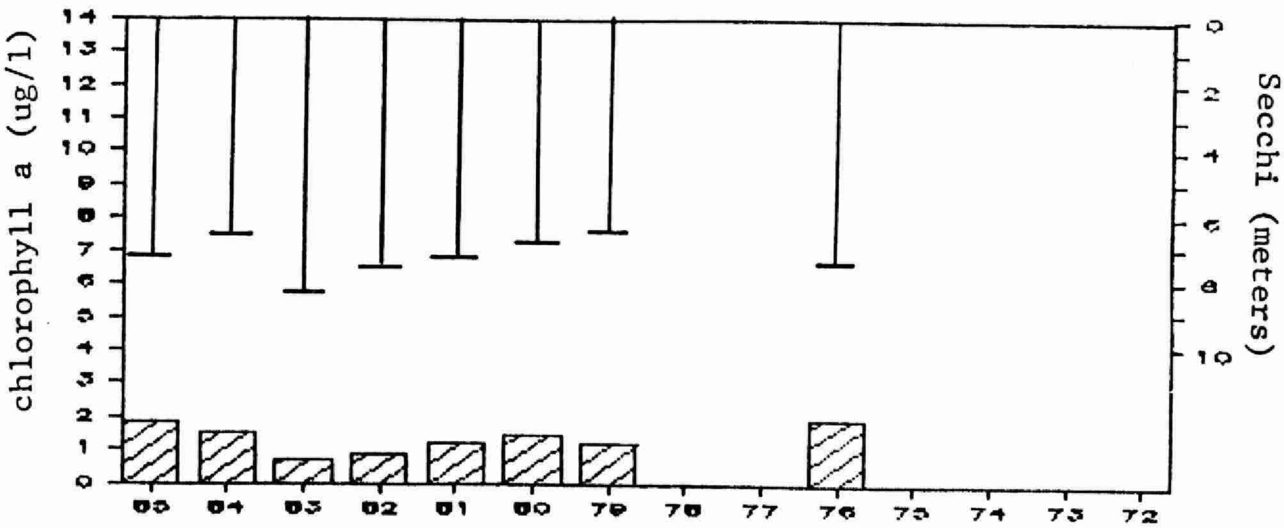

Bob's(long bay)
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72


Bobs(mudbay)
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

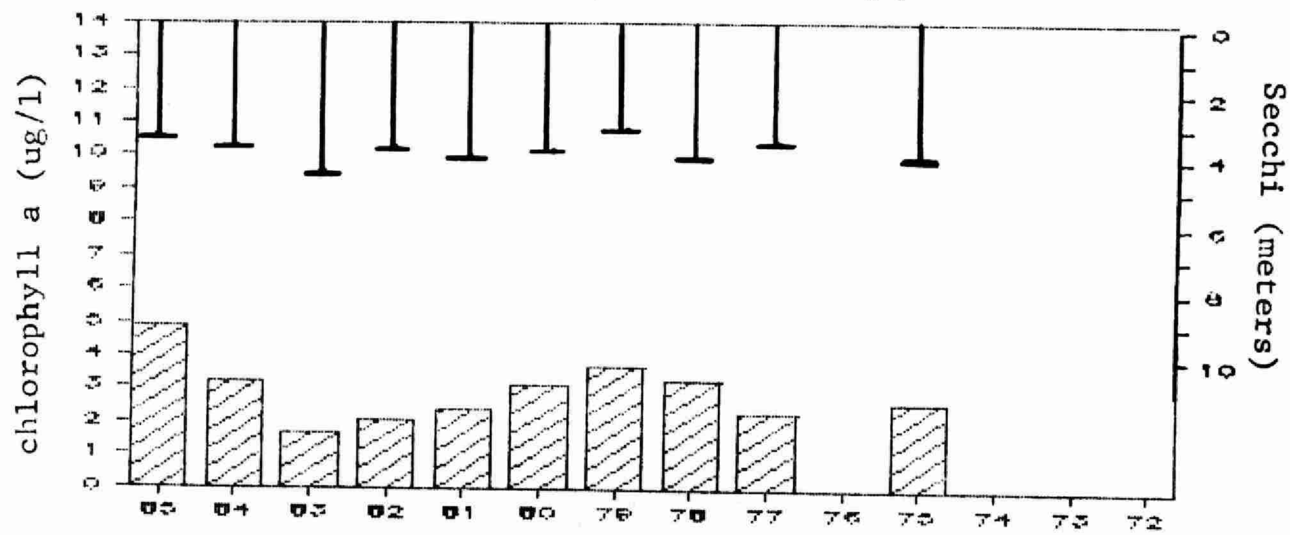
Bobs(west basin)



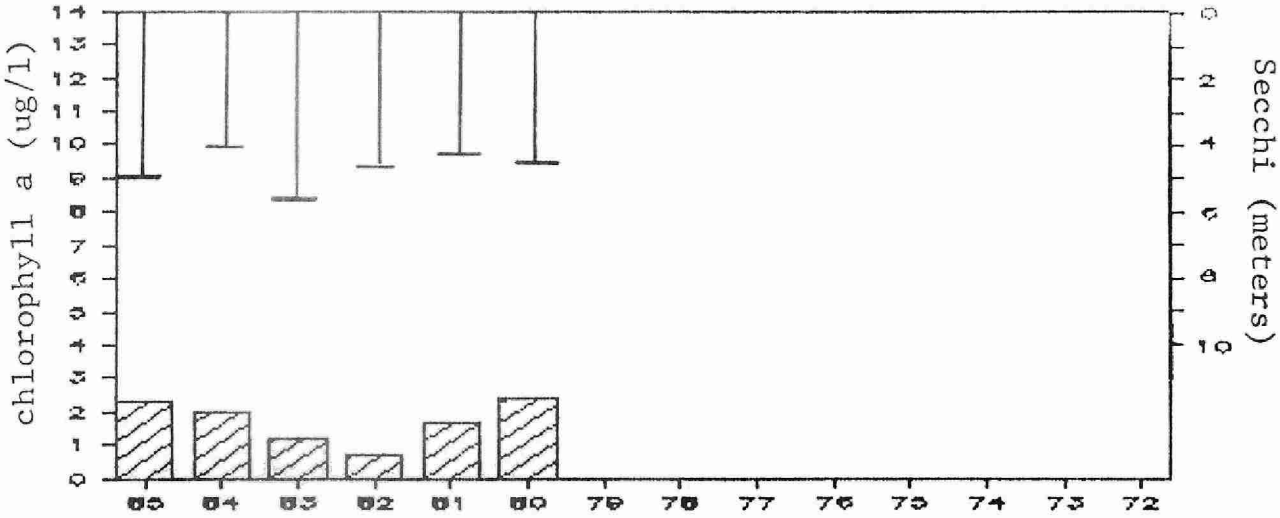
Brule



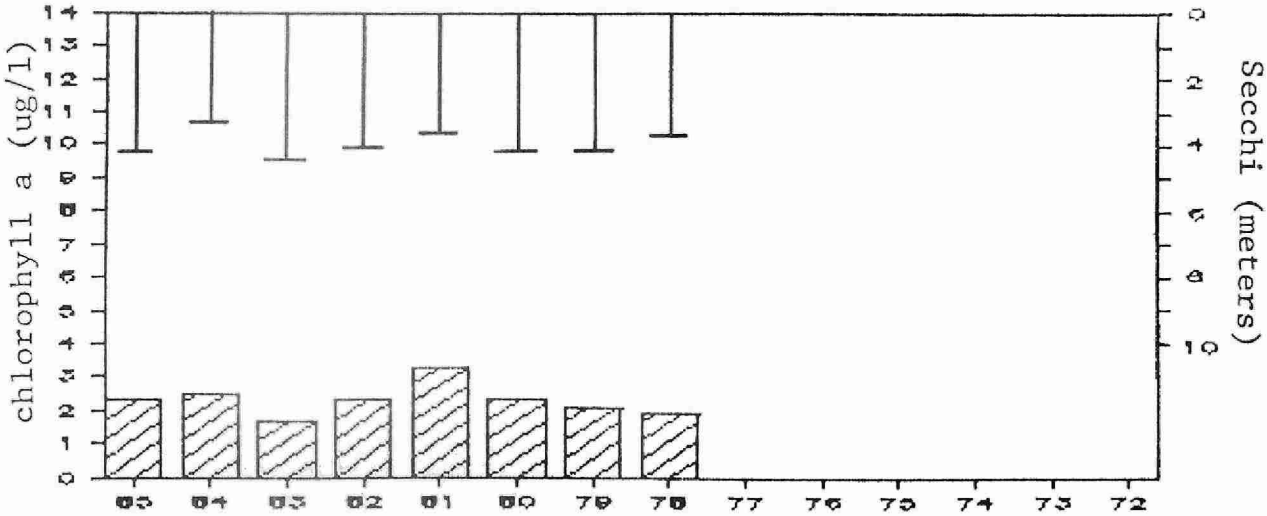
Buck (North Bay)



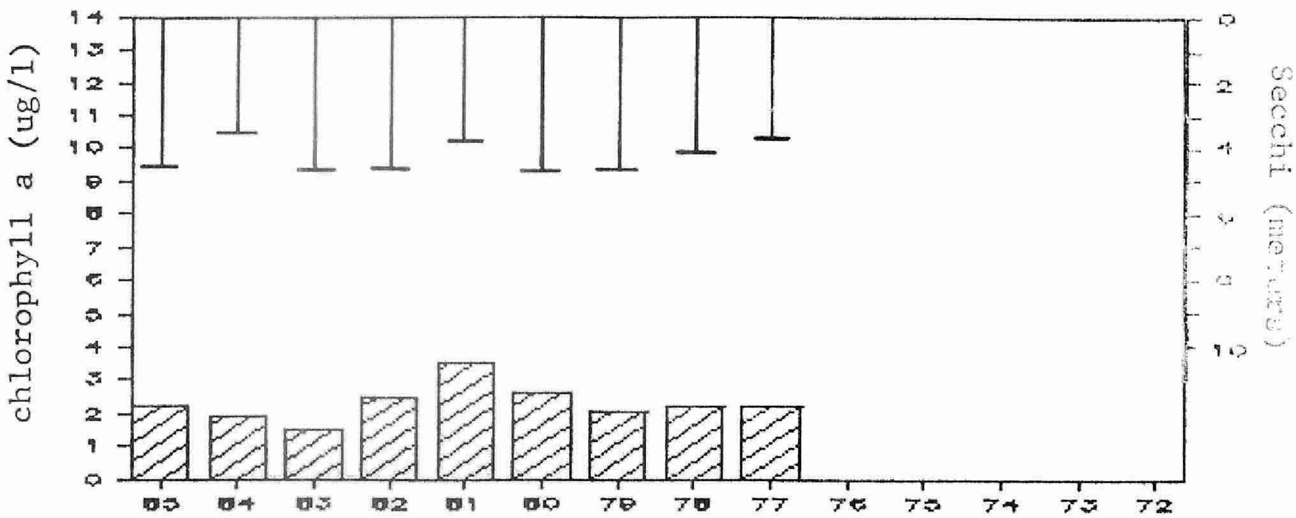
Burridge



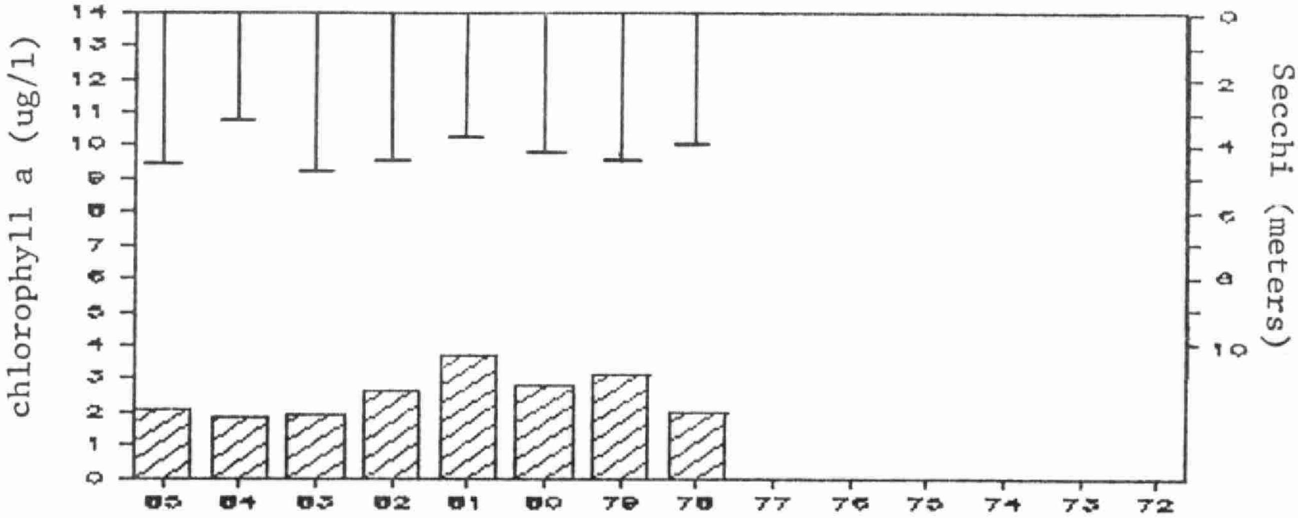
Charleston(near goose island)



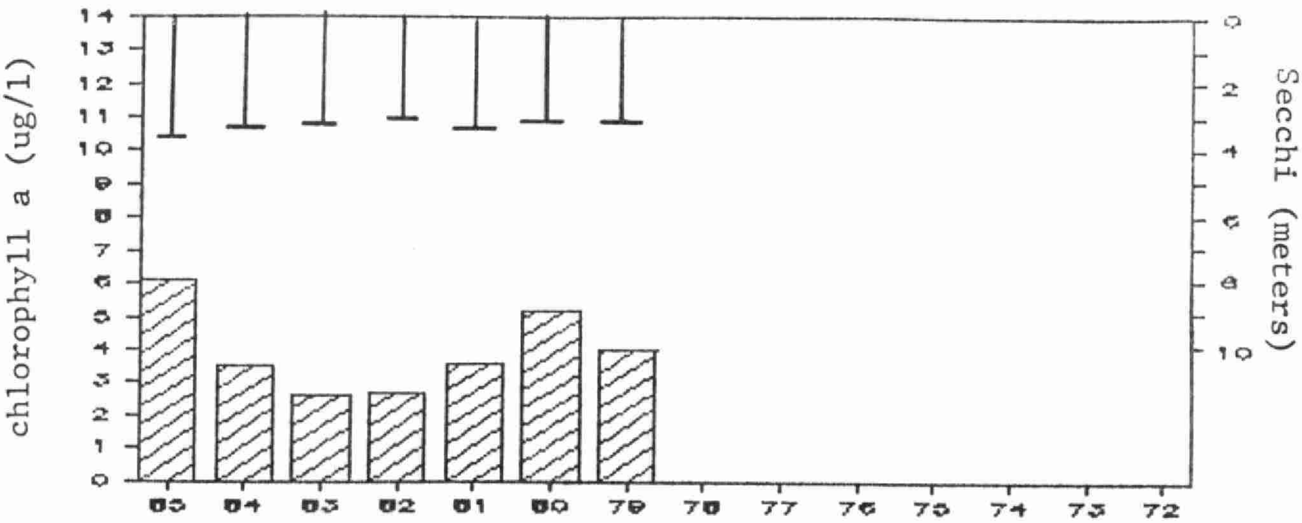
Charleston(webstersbay)



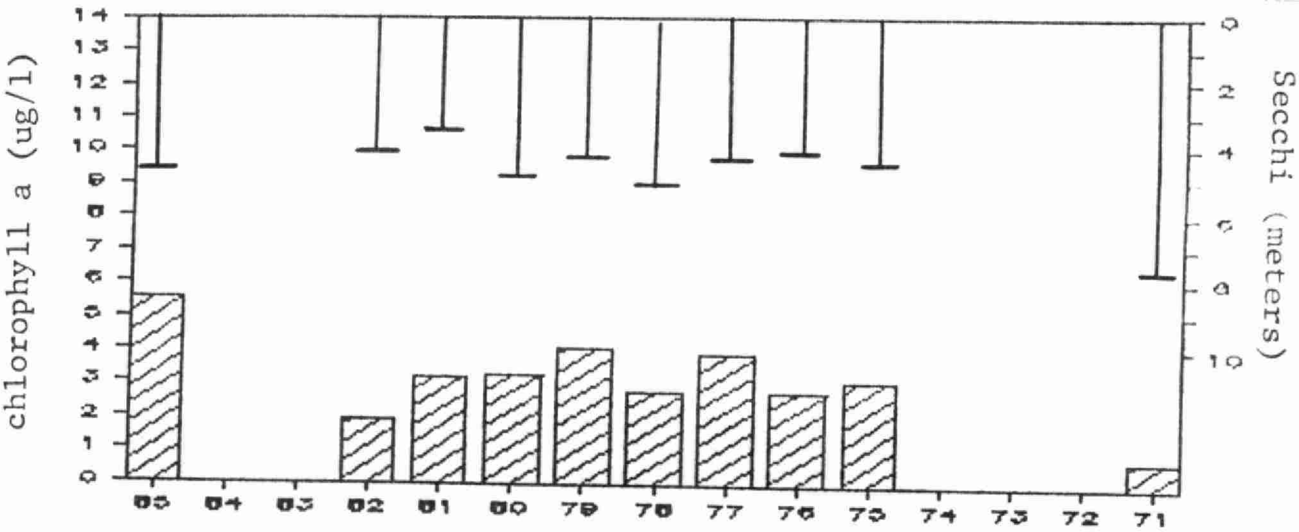
Charleston(western water)

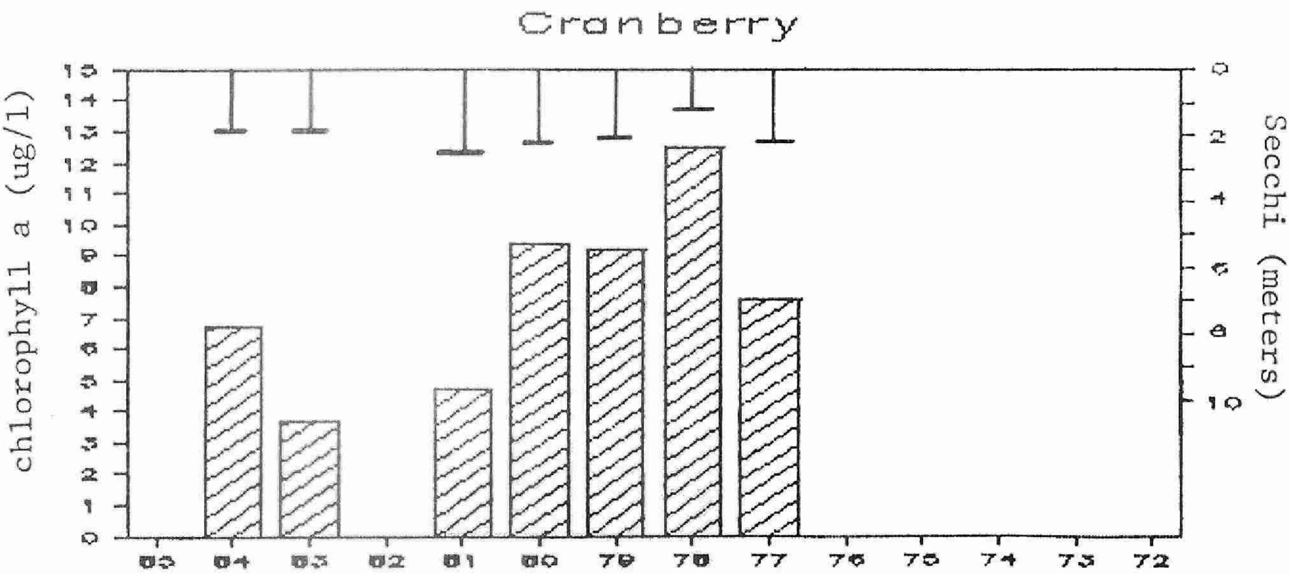


Chippego

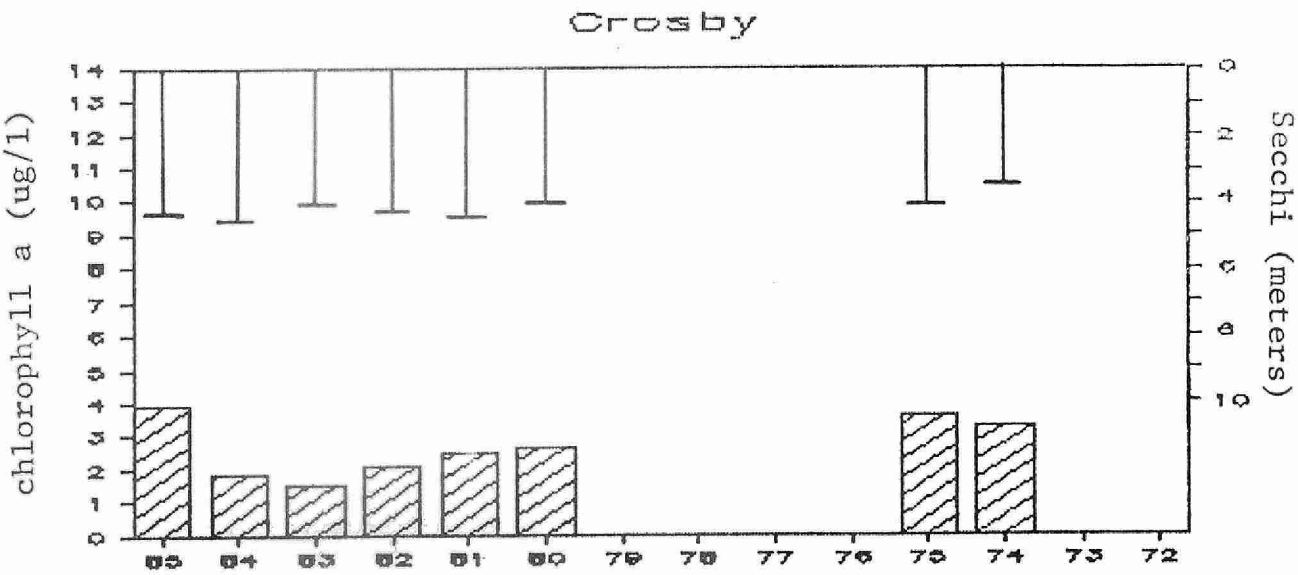


Christie

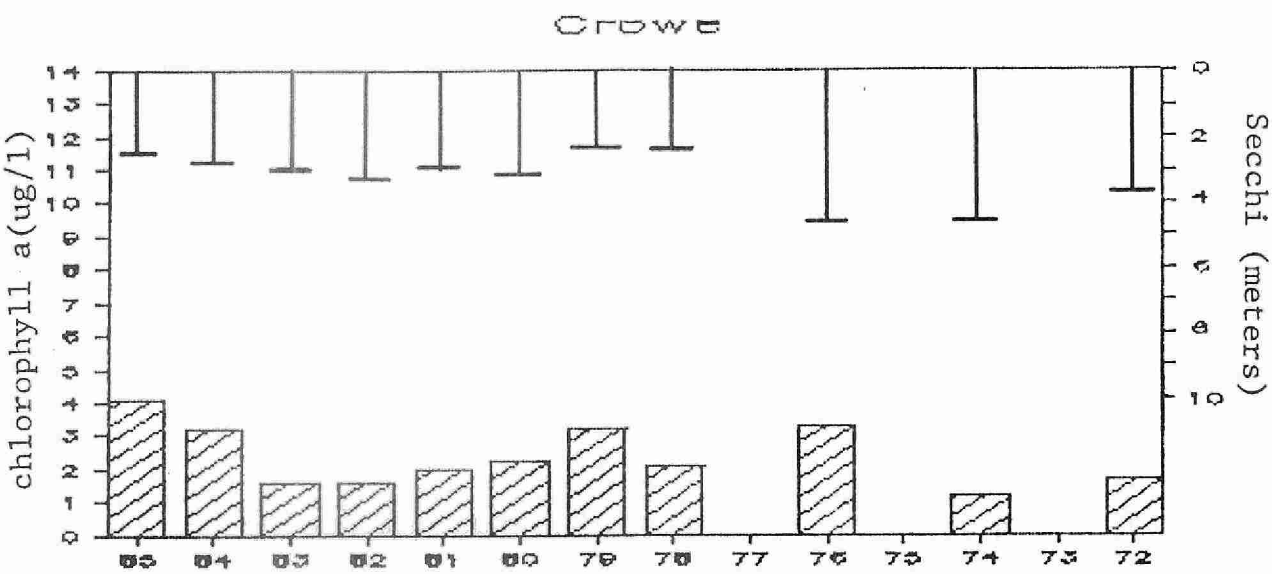




Cranberry
chlorophyll a (ug/l)
Secchi (meters)
85
84
83
82
81
80
79
78
77
76
75
74
73
72

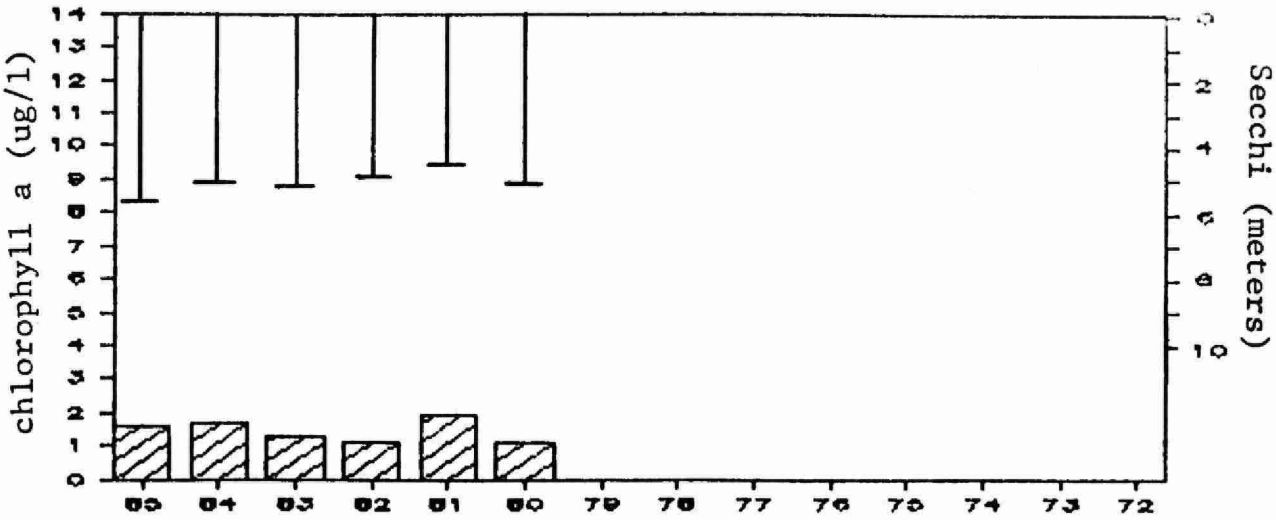


Crosby
chlorophyll a (ug/l)
Secchi (meters)
85
84
83
82
81
80
79
78
77
76
75
74
73
72

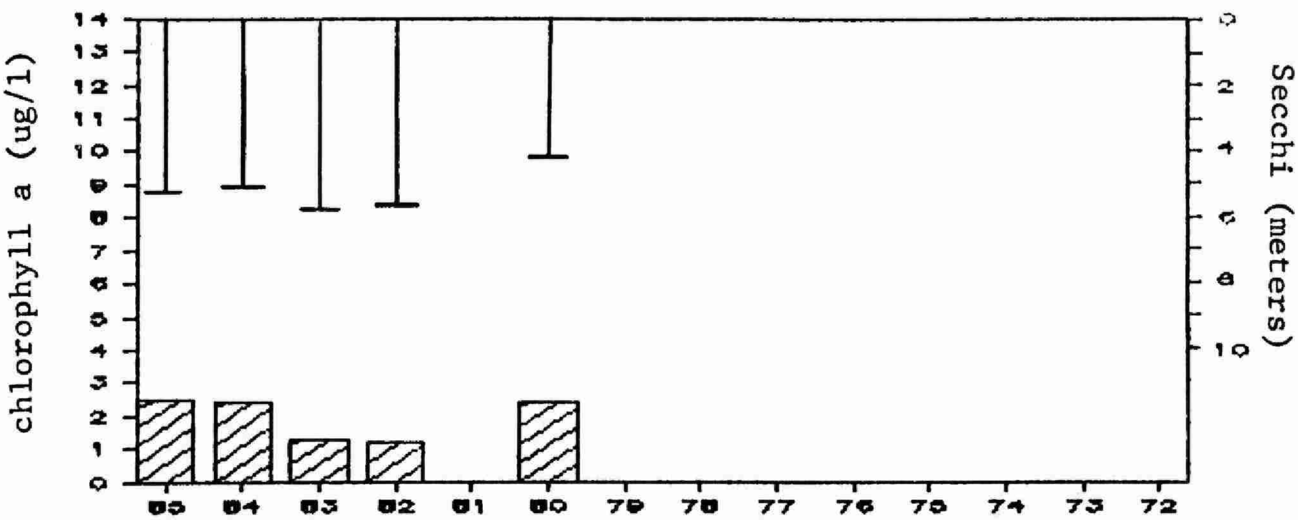


Crowe
chlorophyll a(ug/l)
Secchi (meters)
85
84
83
82
81
80
79
78
77
76
75
74
73
72

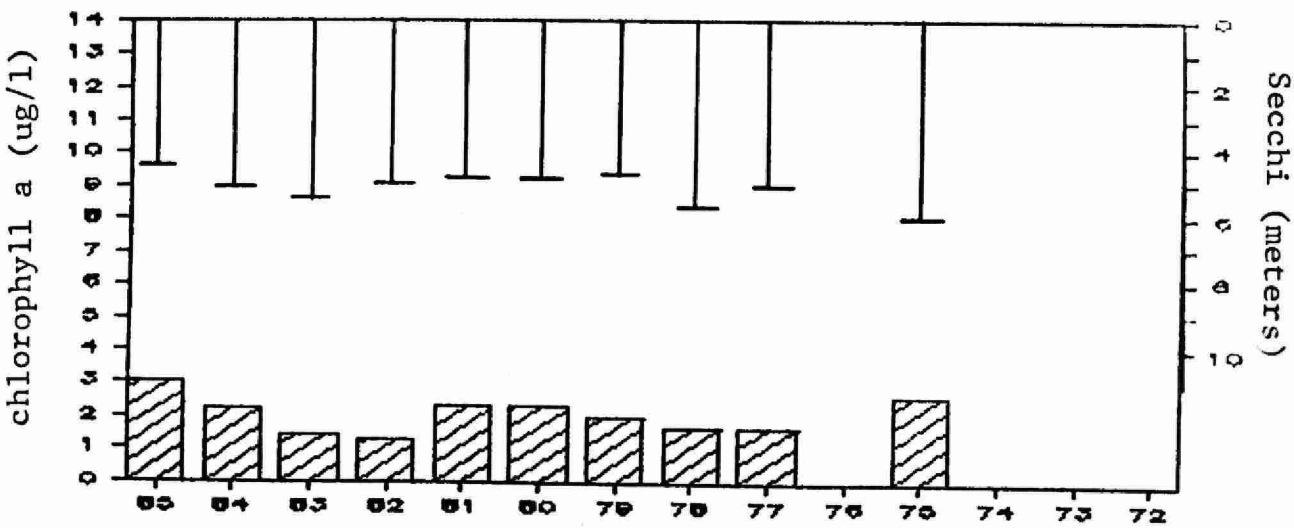
Davern

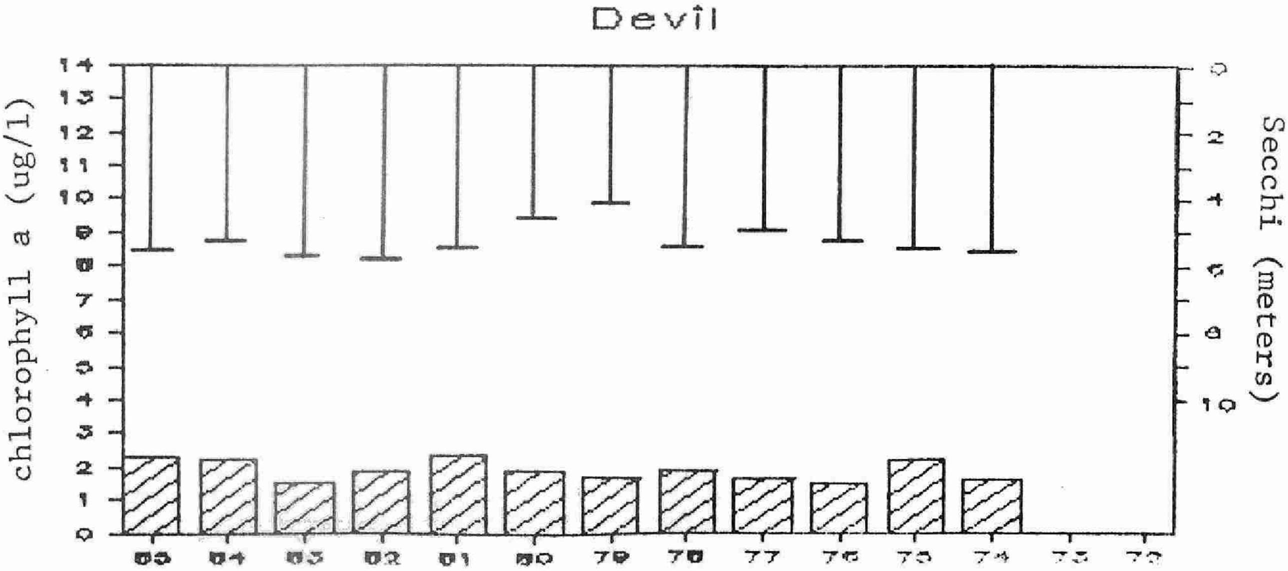


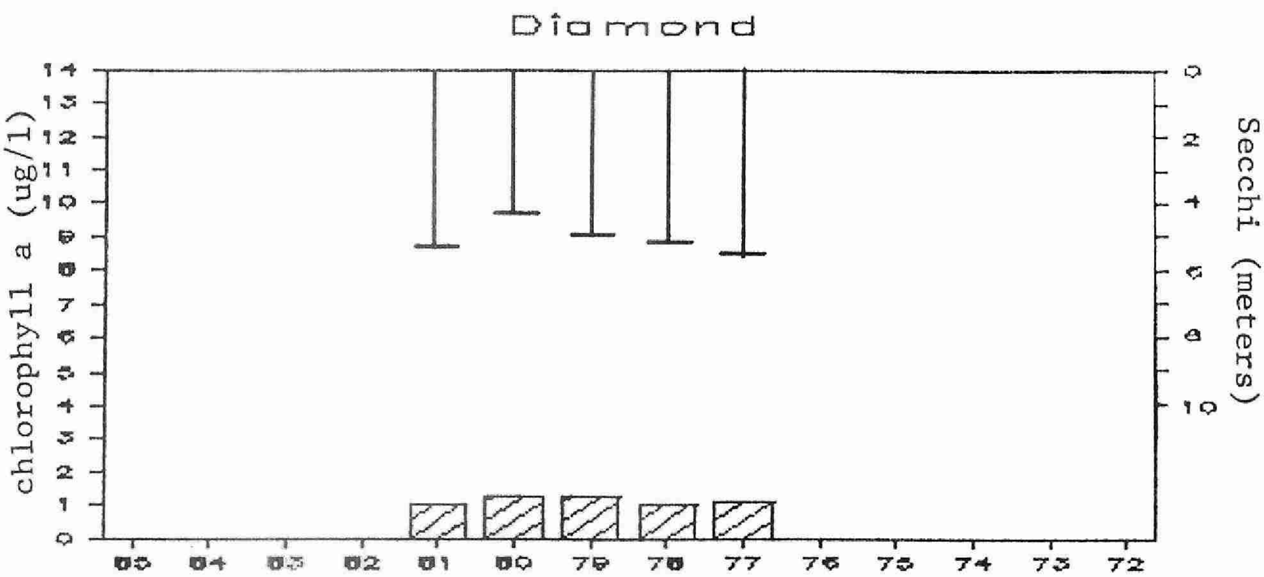
Dempsey's

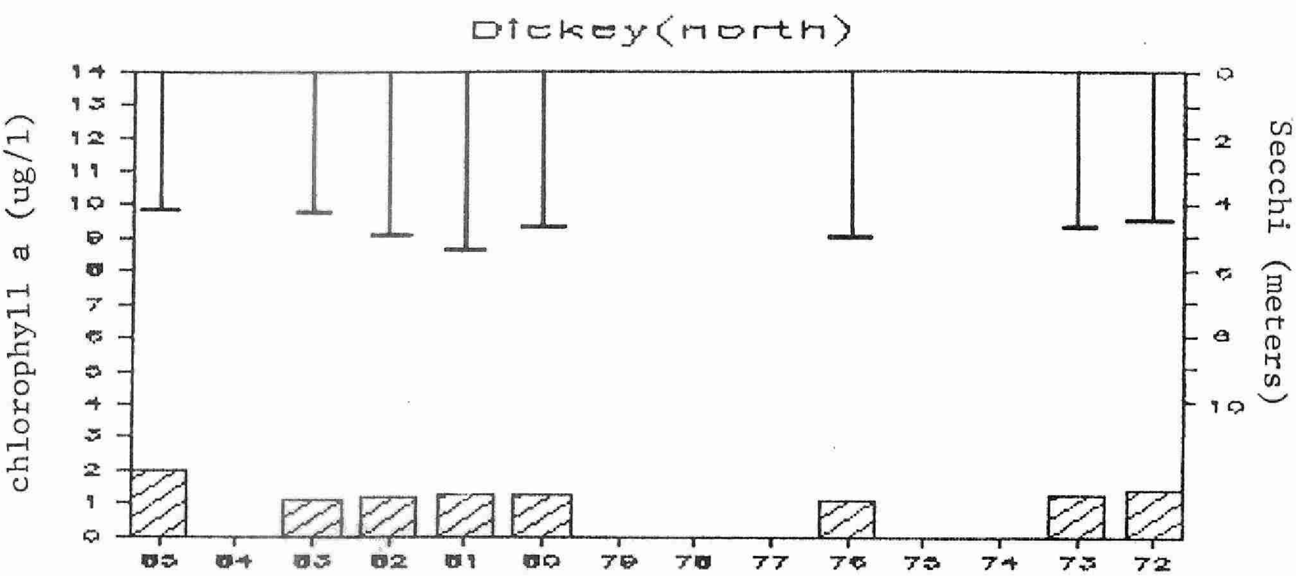


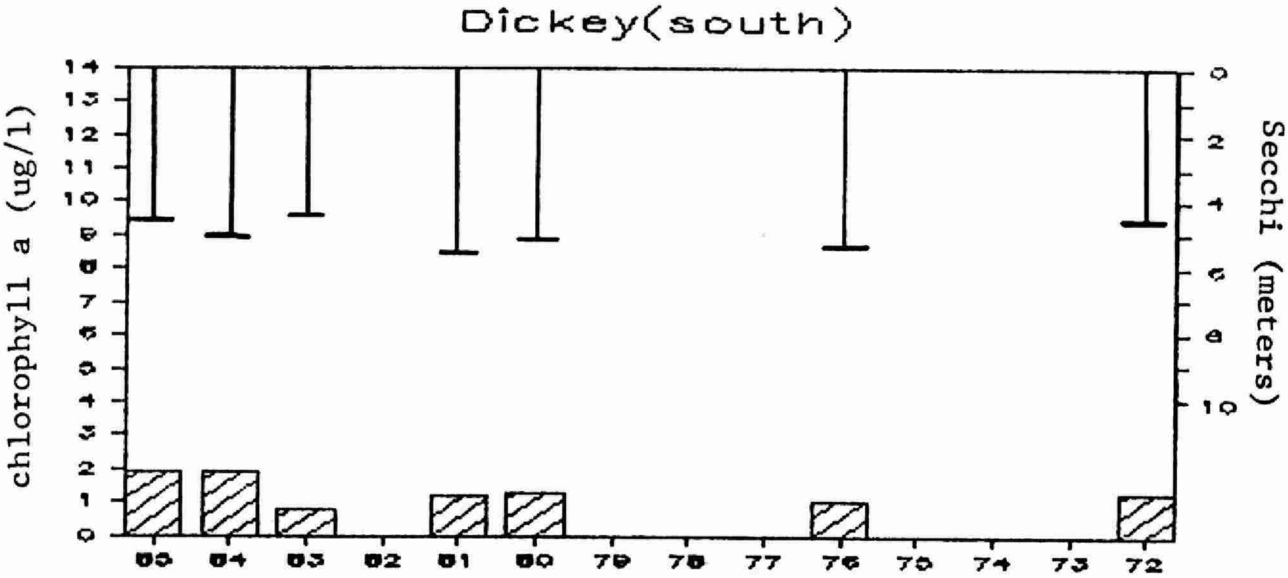
Desert

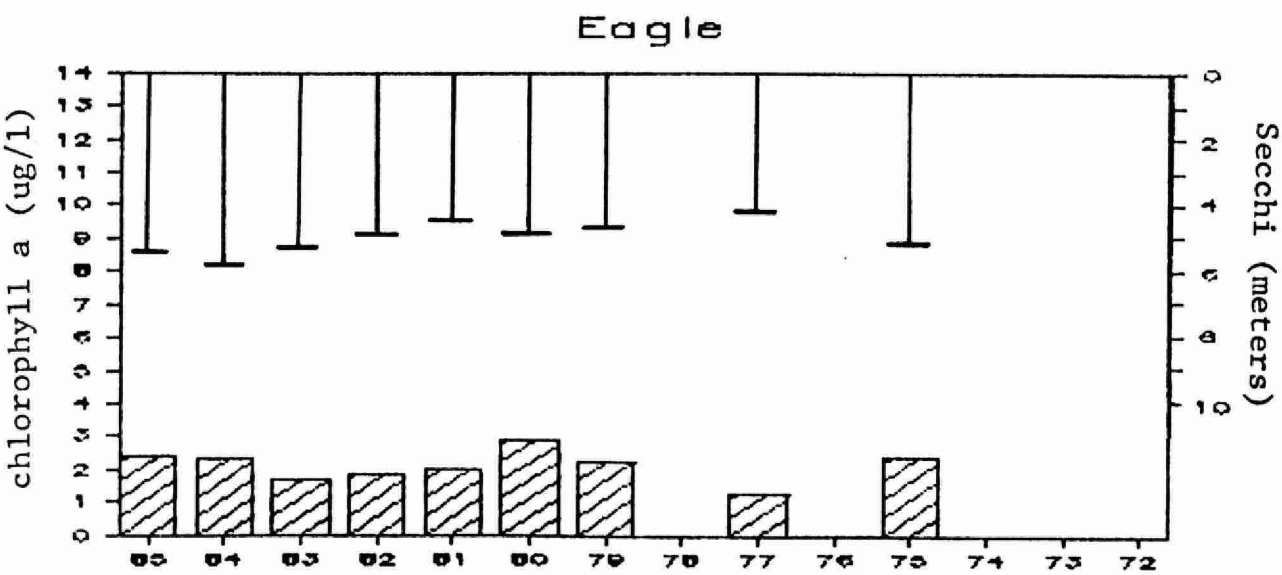


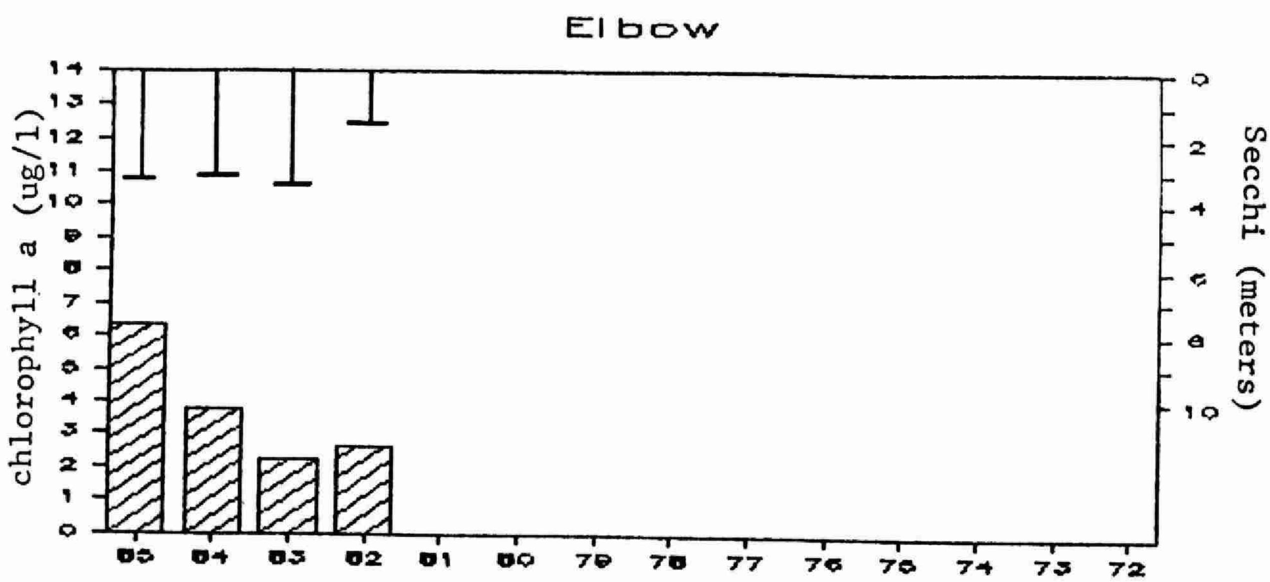

Devil
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

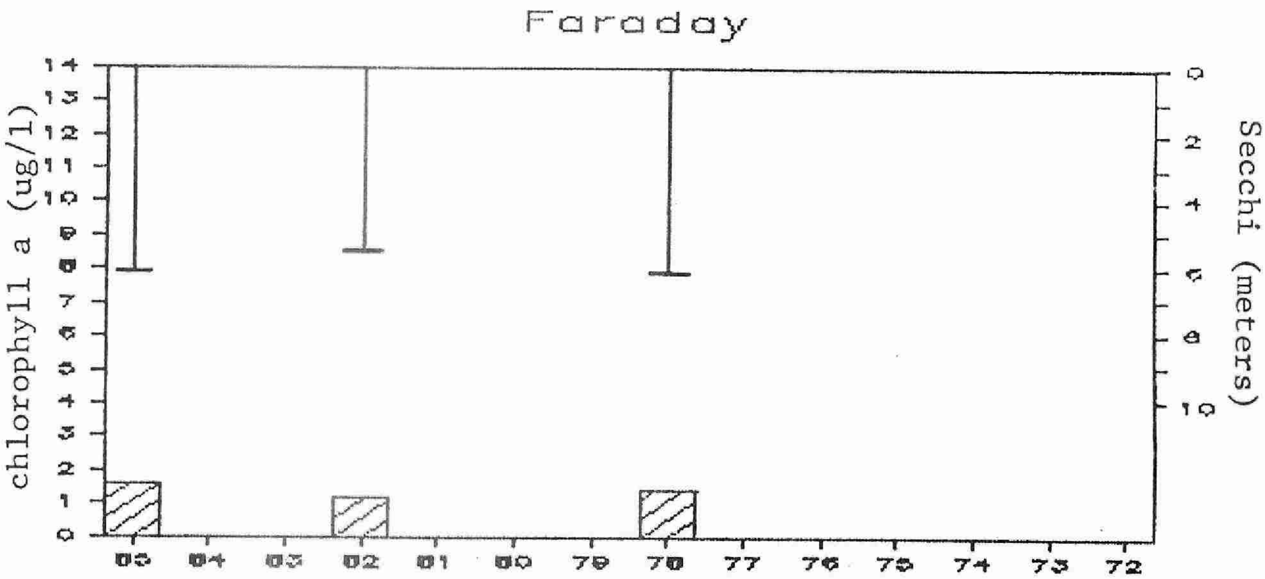

Diamond
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

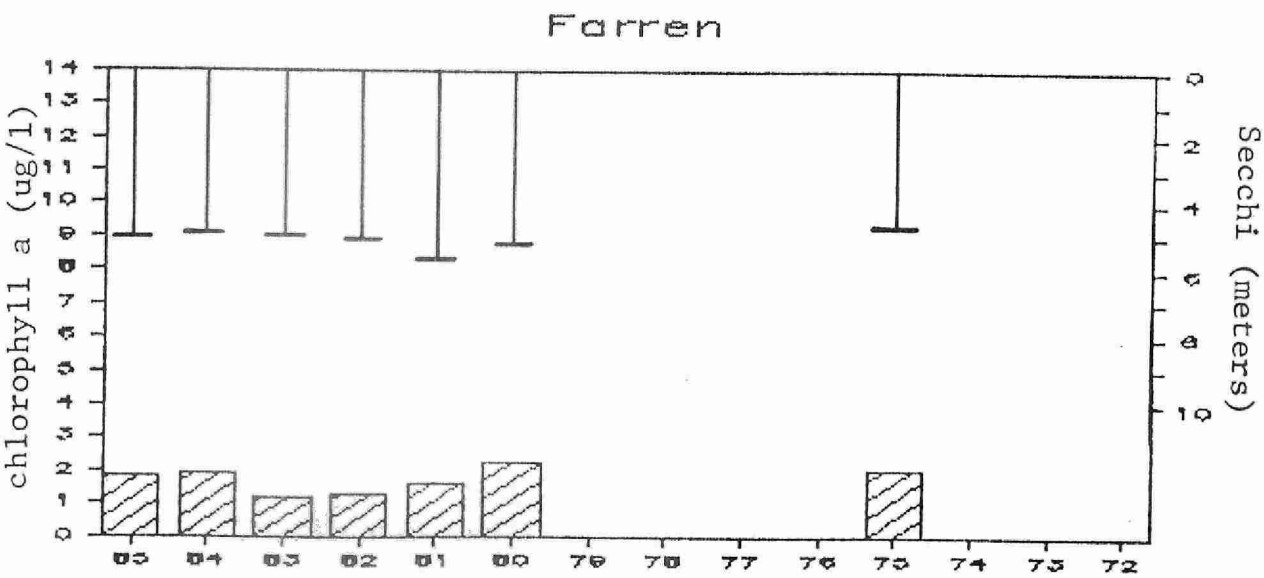

Dickey(north)
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

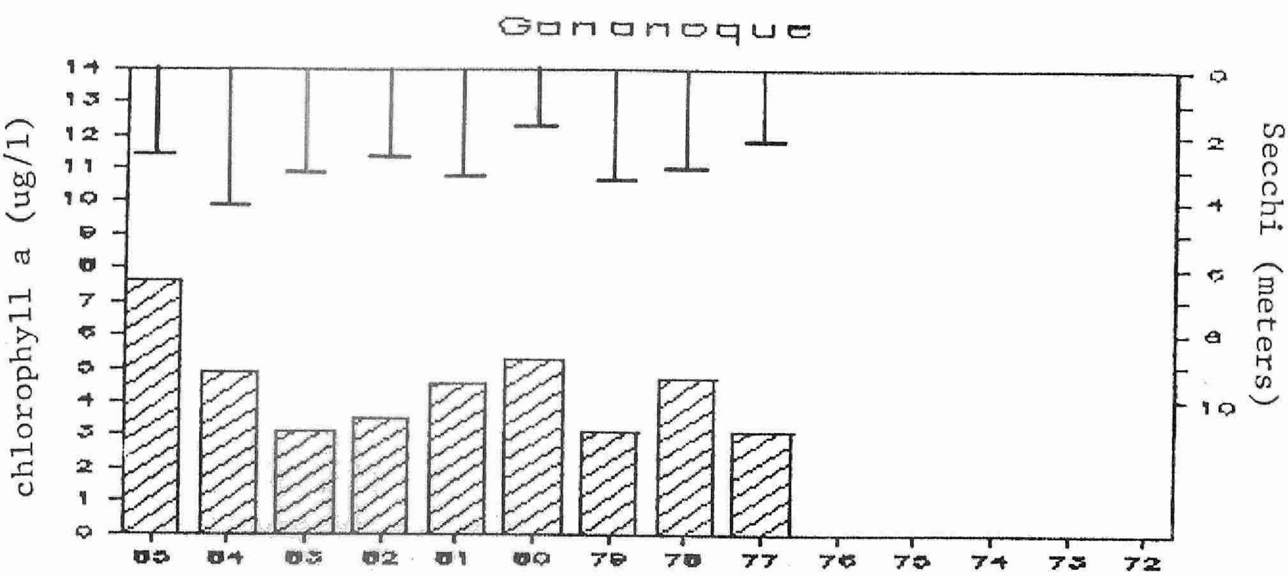

Dickey(south)
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

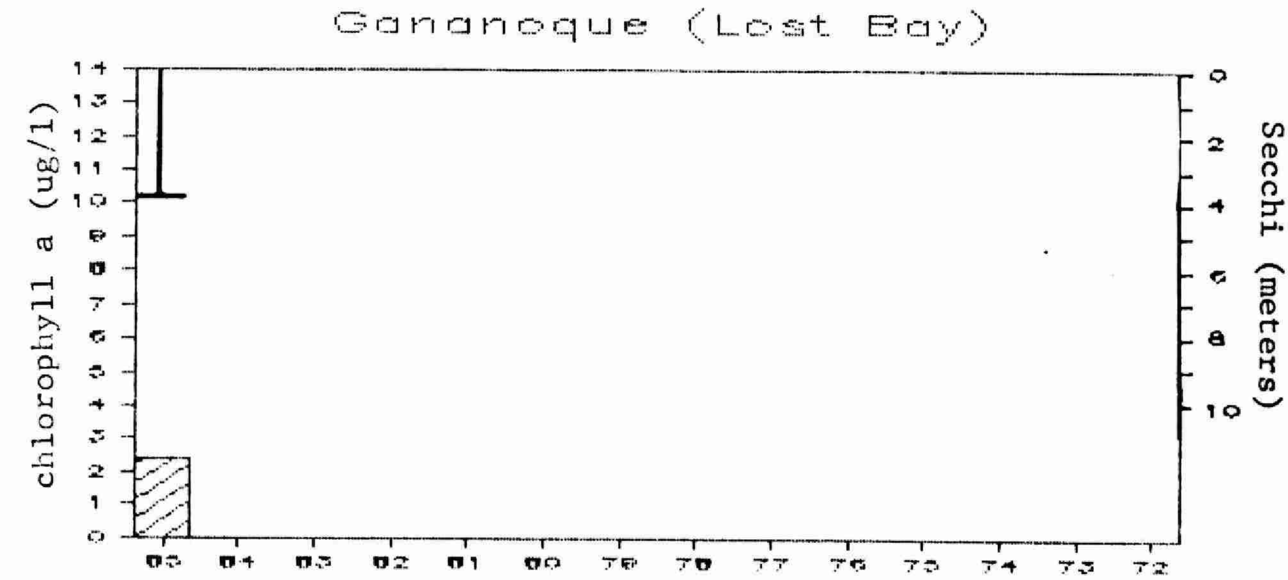

Eagle
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

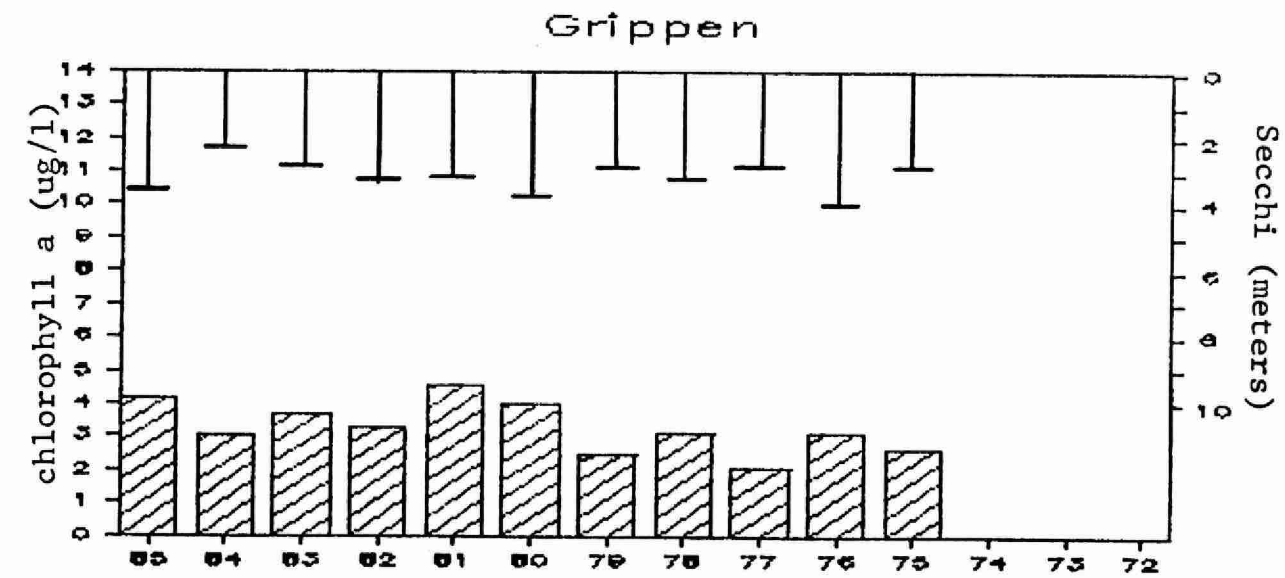

Elbow
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

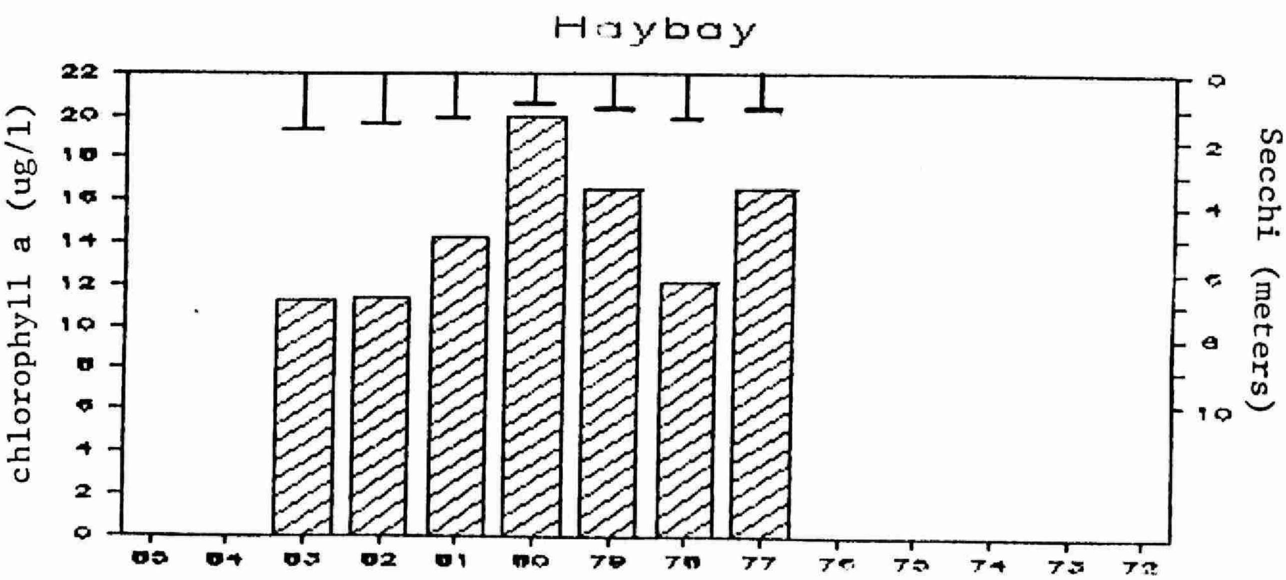

Faraday
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

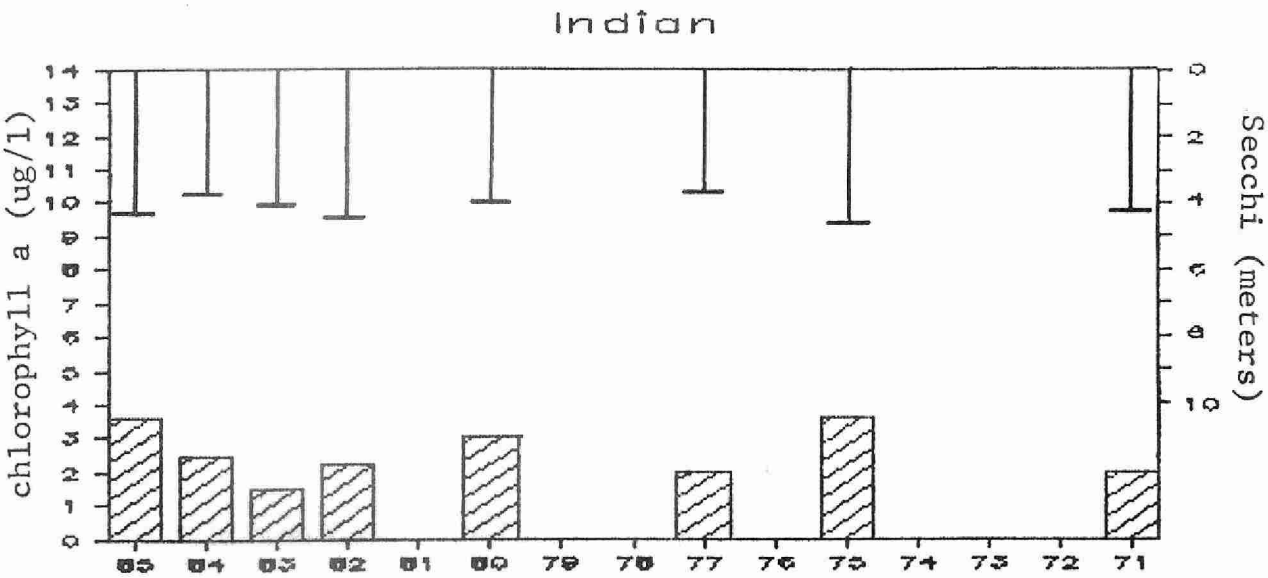

Farren
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

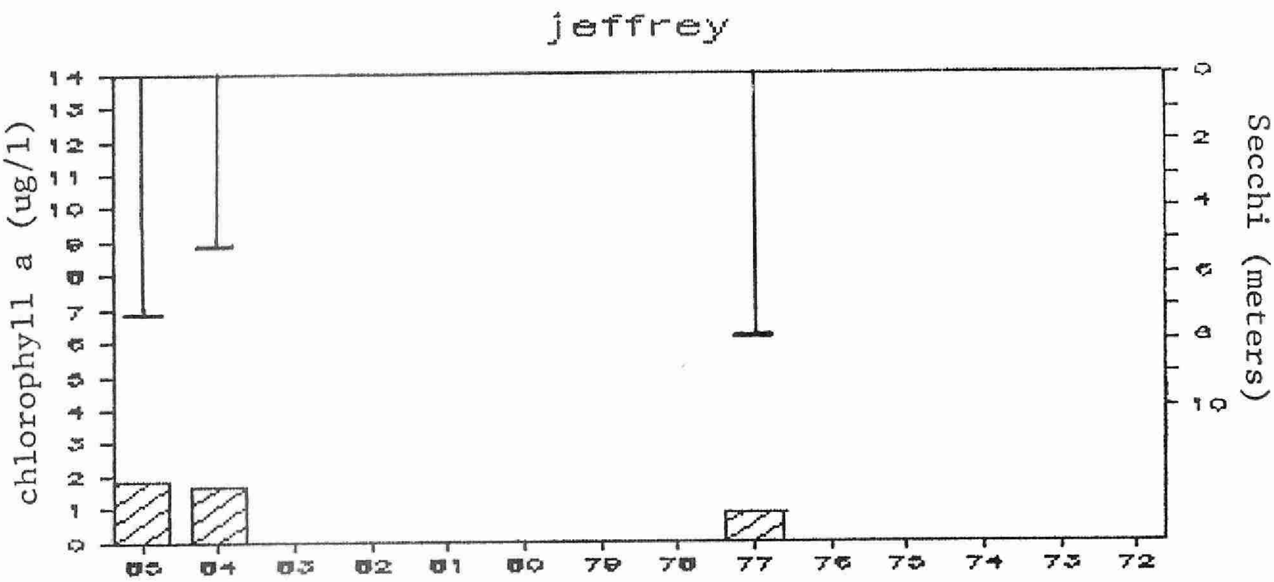

Gananoque
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

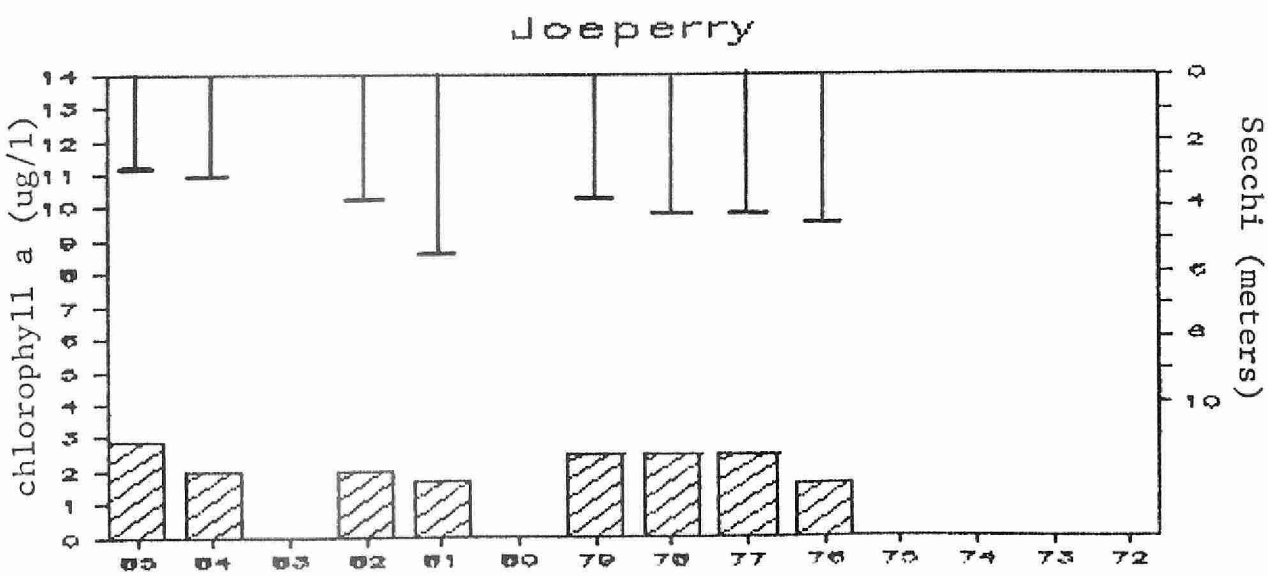

Gananoque (Lost Bay)
chlorophyll a (ug/l)
Secchi (meters)
14
13
12
11
10
0
85
84
83
82
81
80
79
78
77
76
75
74
73
72

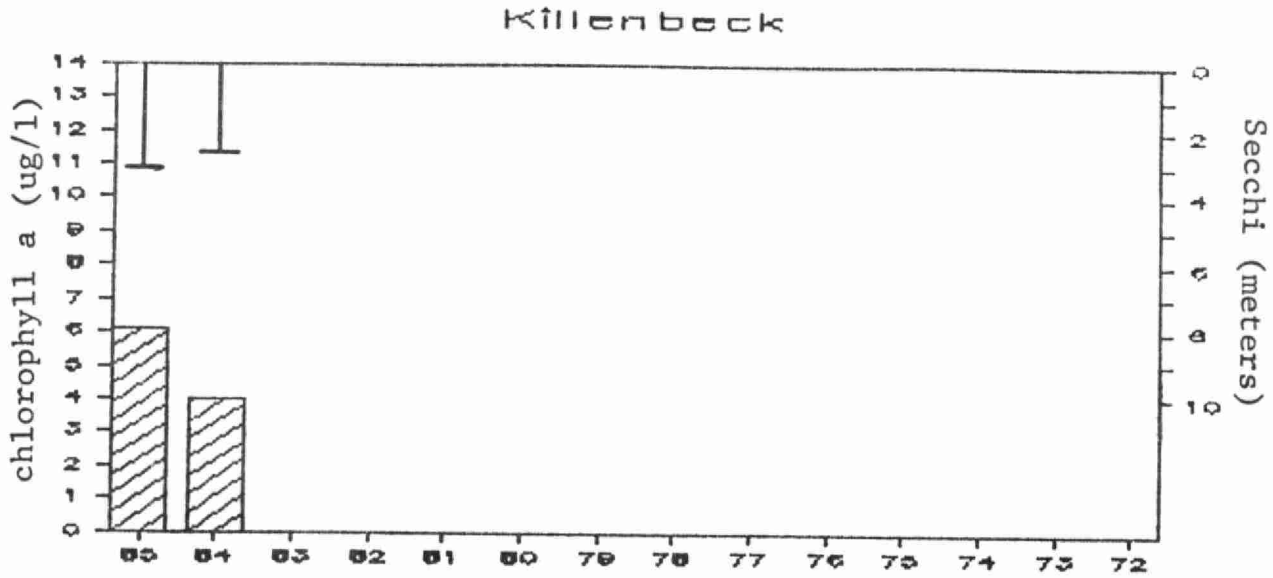

Grippen
chlorophyll a (ug/l)
Secchi (meters)
14
13
12
11
10
7
4
3
2
1
0
2
4
10
84
83
82
81
80
79
78
77
76
75
74
73
72

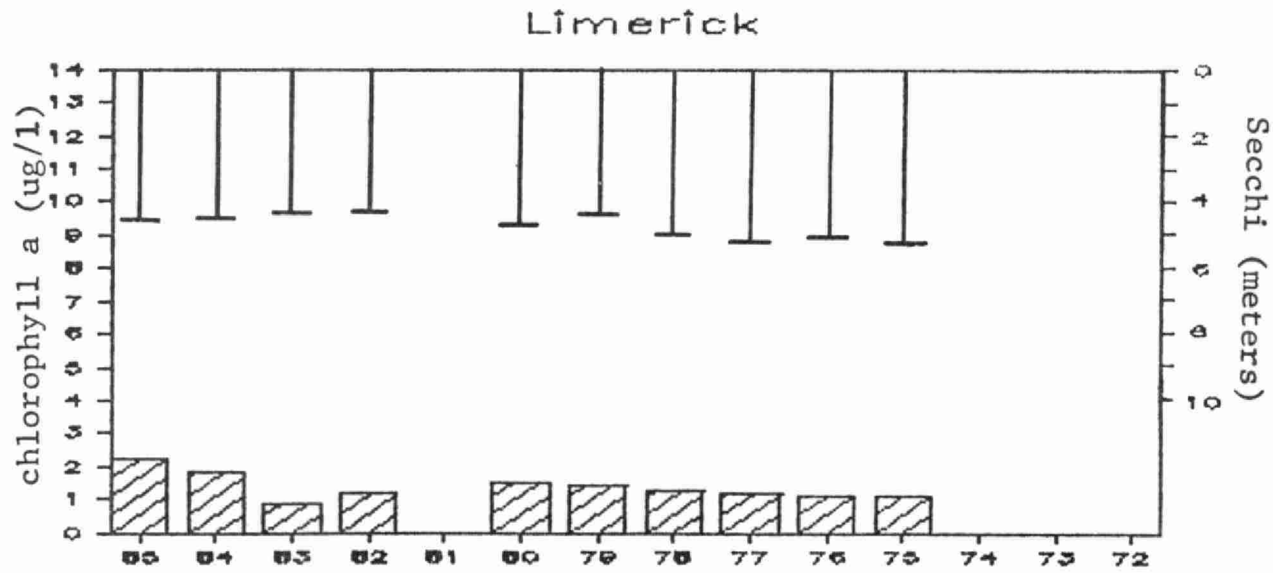

Haybay
chlorophyll a (ug/l)
Secchi (meters)
22
20
14
12
10
4
2
0
2
4
10
84
83
82
81
80
79
78
77
76
75
74
73
72

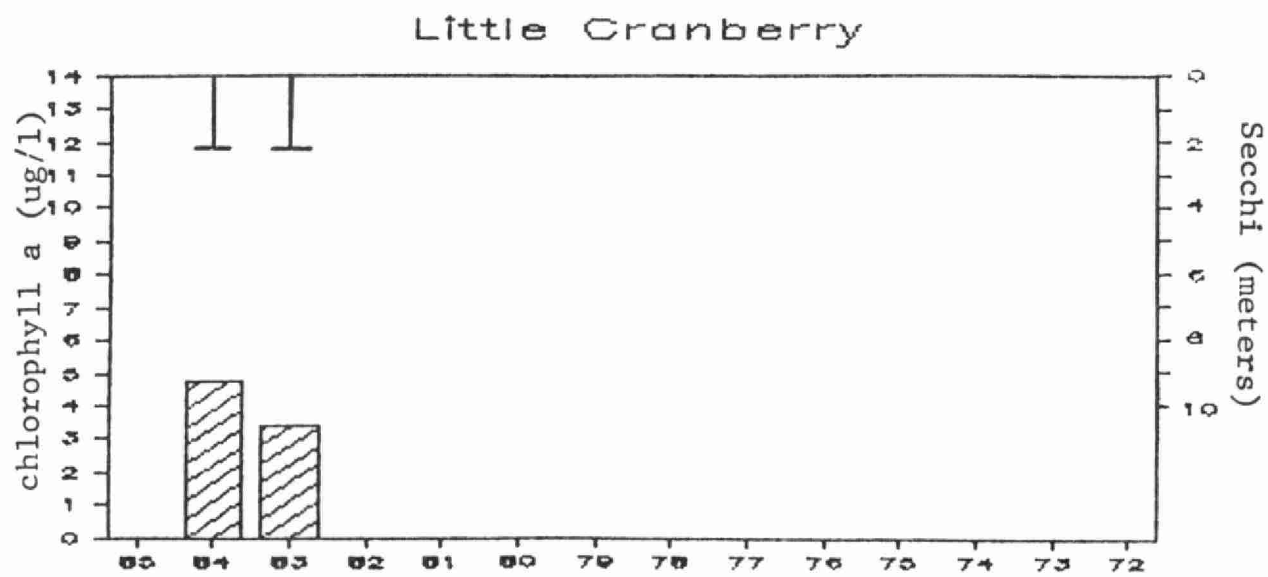

Indian
chlorophyll a (ug/1)
Secchi (meters)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72 71

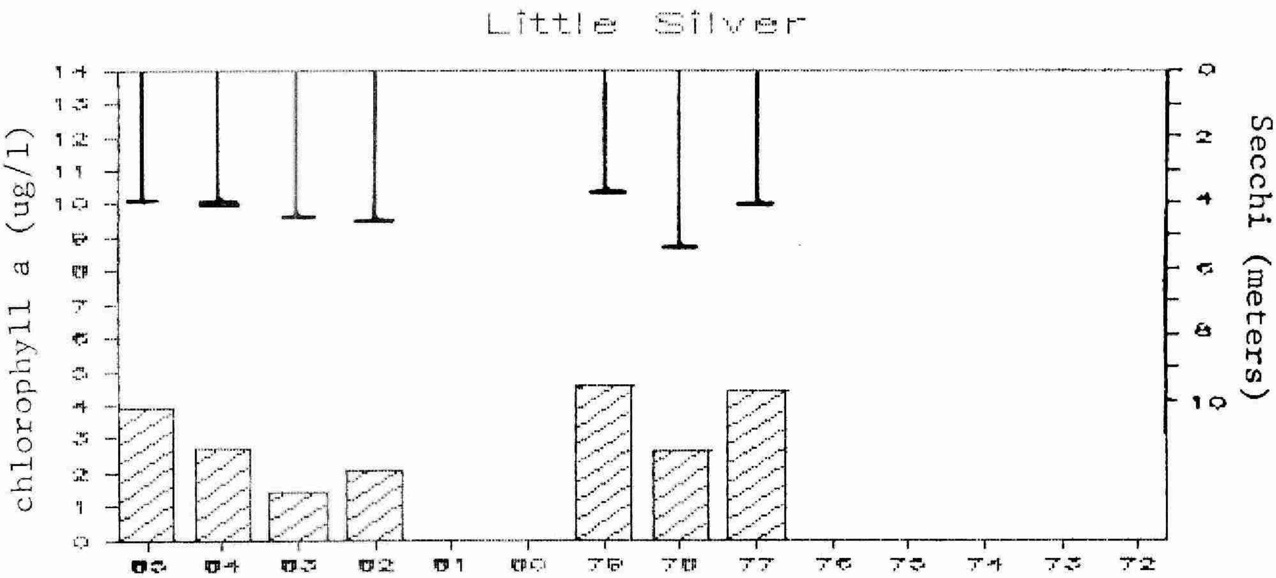

jeffrey
chlorophyll a (ug/1)
Secchi (meters)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72


Joeperry
chlorophyll a (ug/1)
Secchi (meters)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72

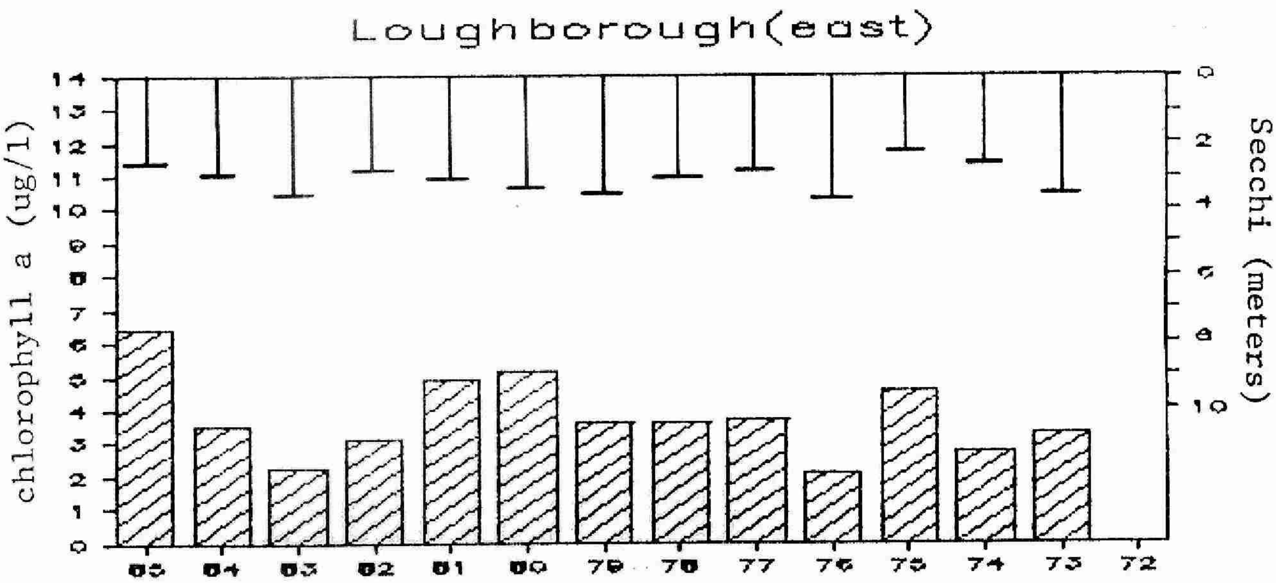

Killenbeck
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72


Limerick
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

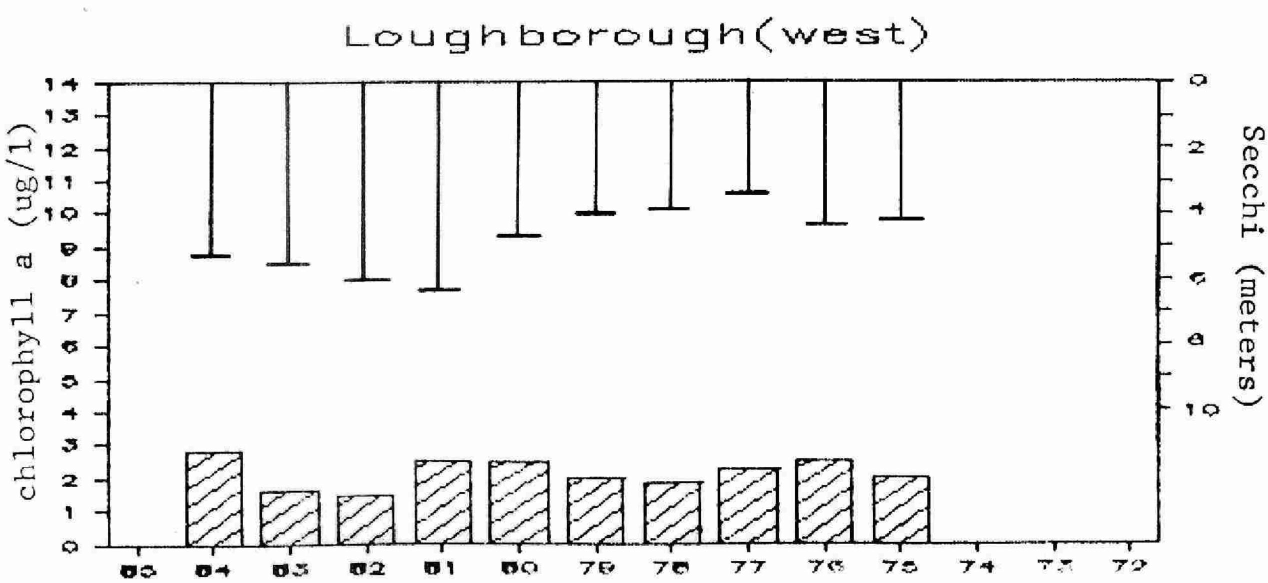

Little Cranberry
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72



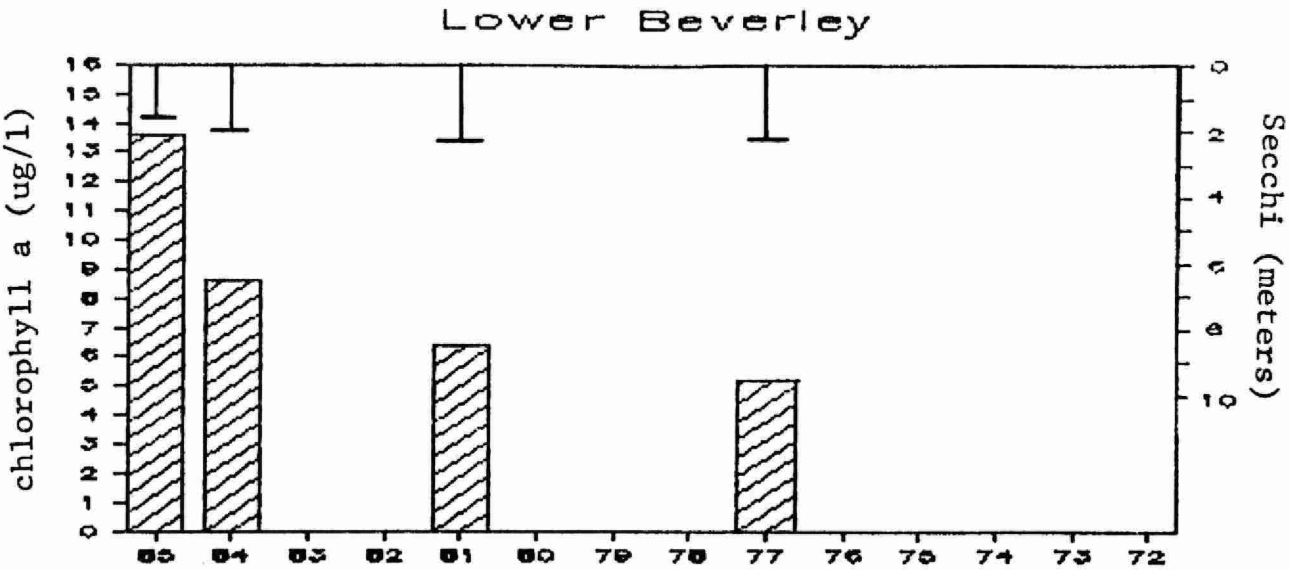
Little Silver
chlorophyll a (ug/1)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72



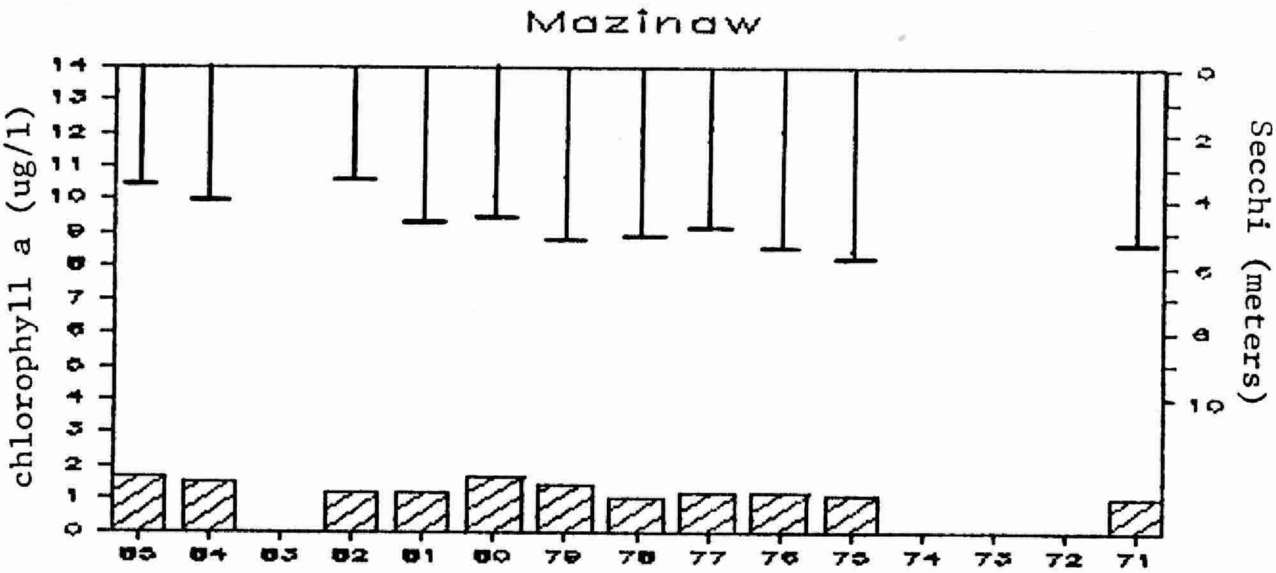
Loughborough(east)
chlorophyll a (ug/1)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72



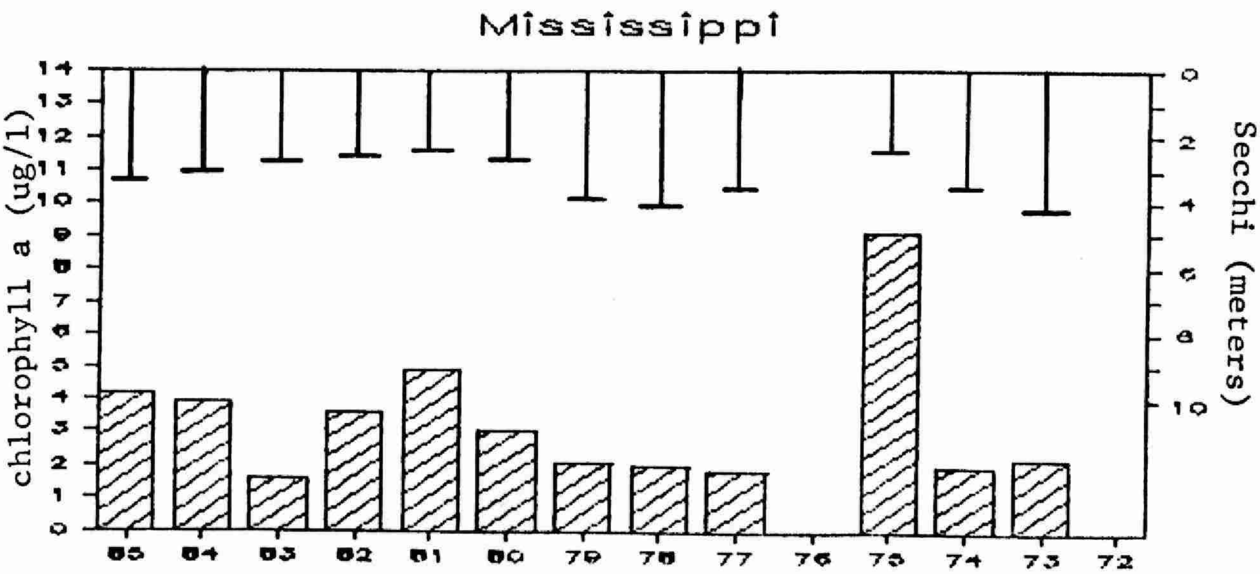
Loughborough(west)
chlorophyll a (ug/1)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72



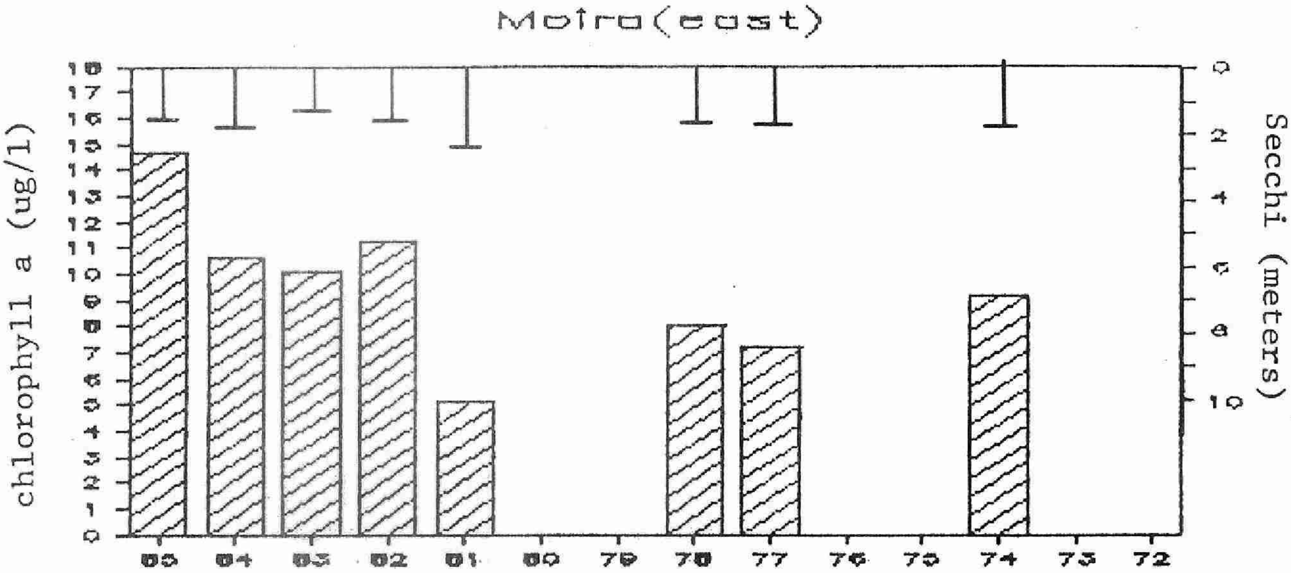
Lower Beverley
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

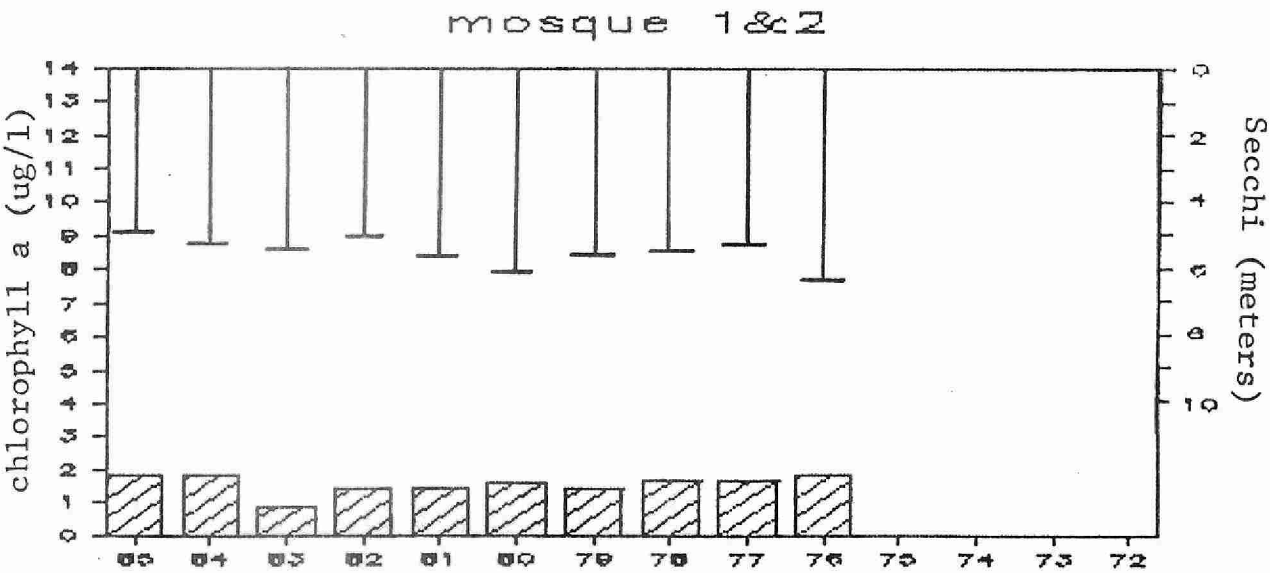


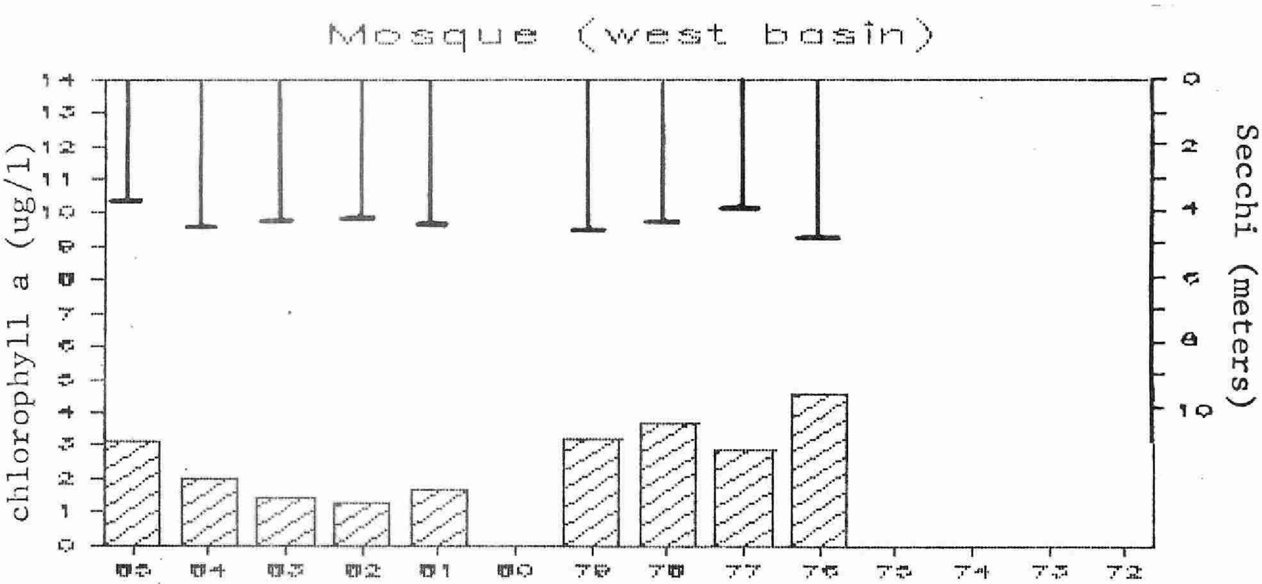
Mazinaw
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72 71

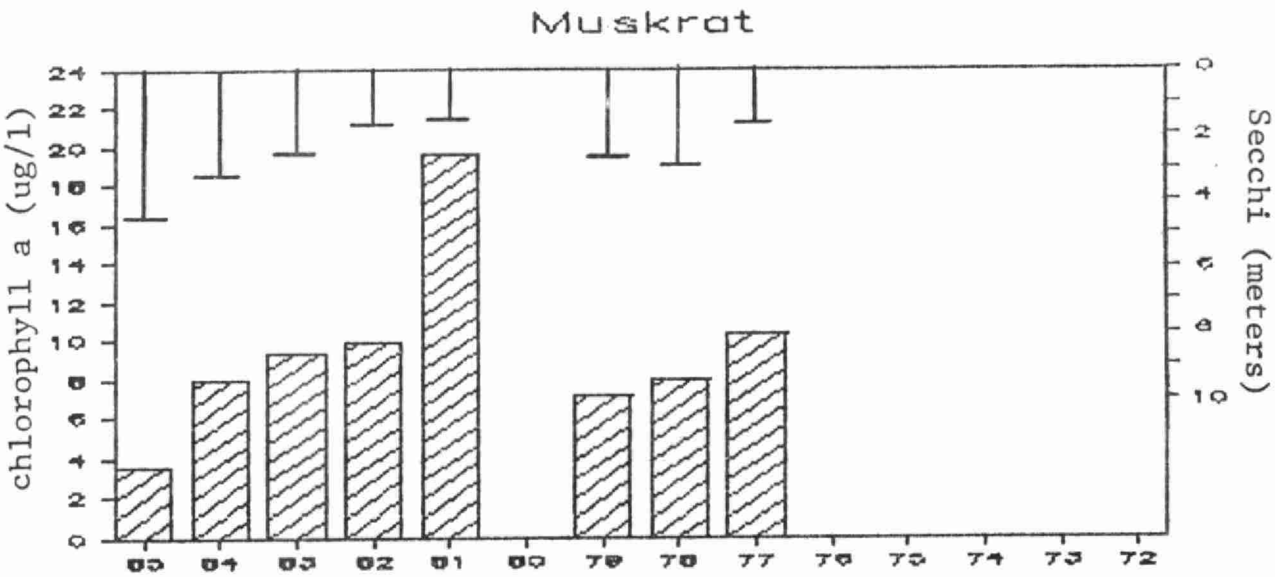


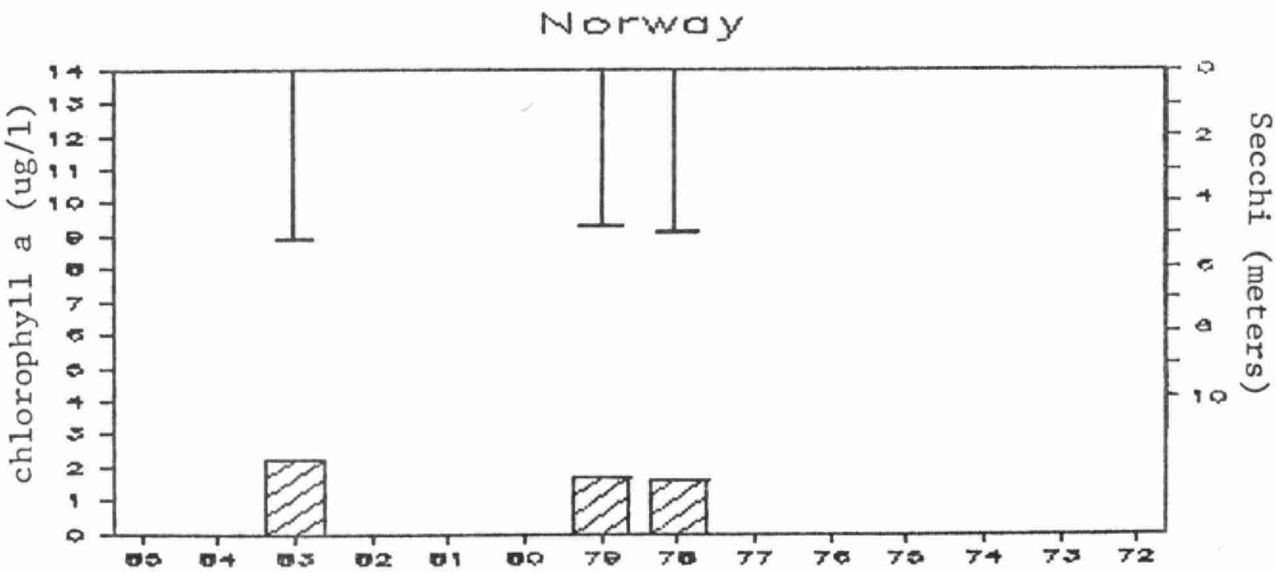
Mississippi
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

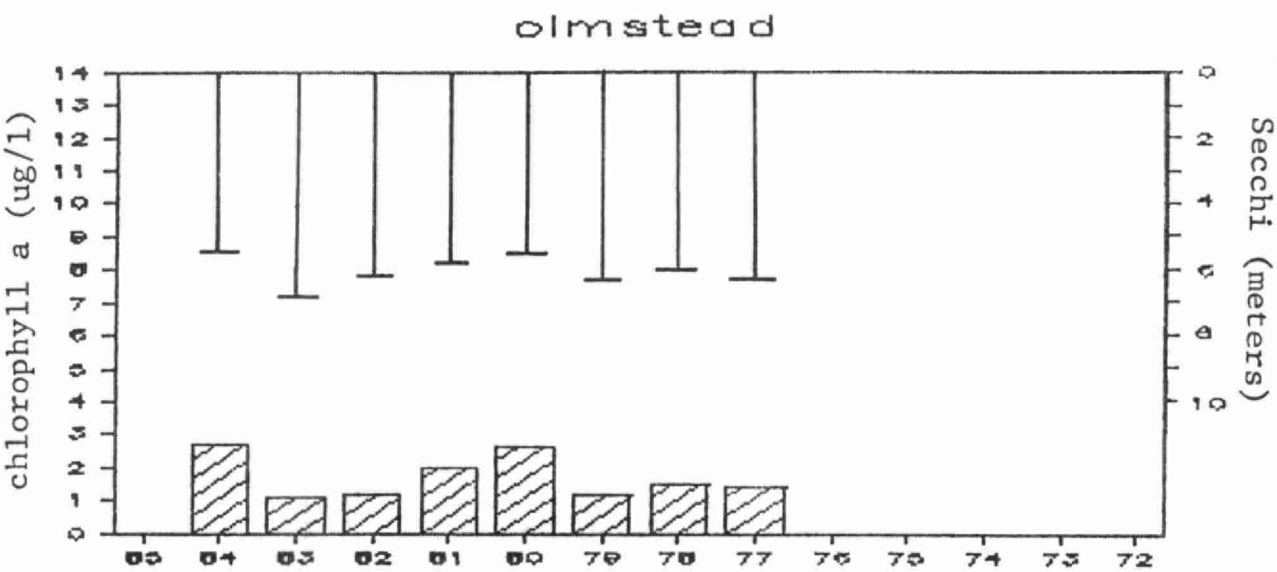

Moira(east)
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

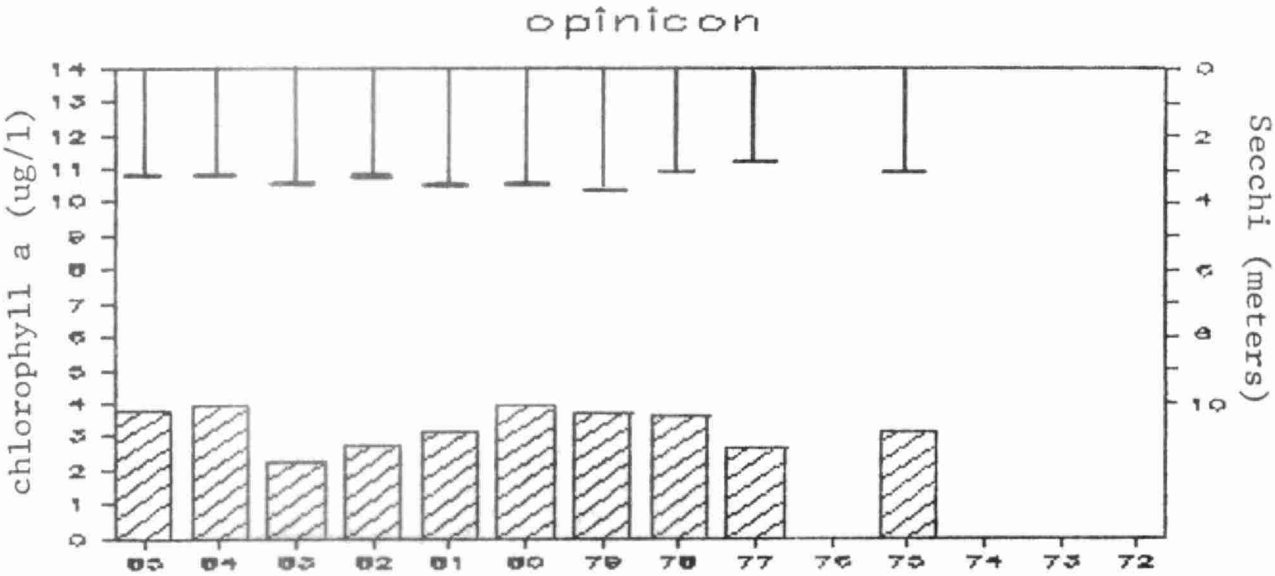

mosque 1&2
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

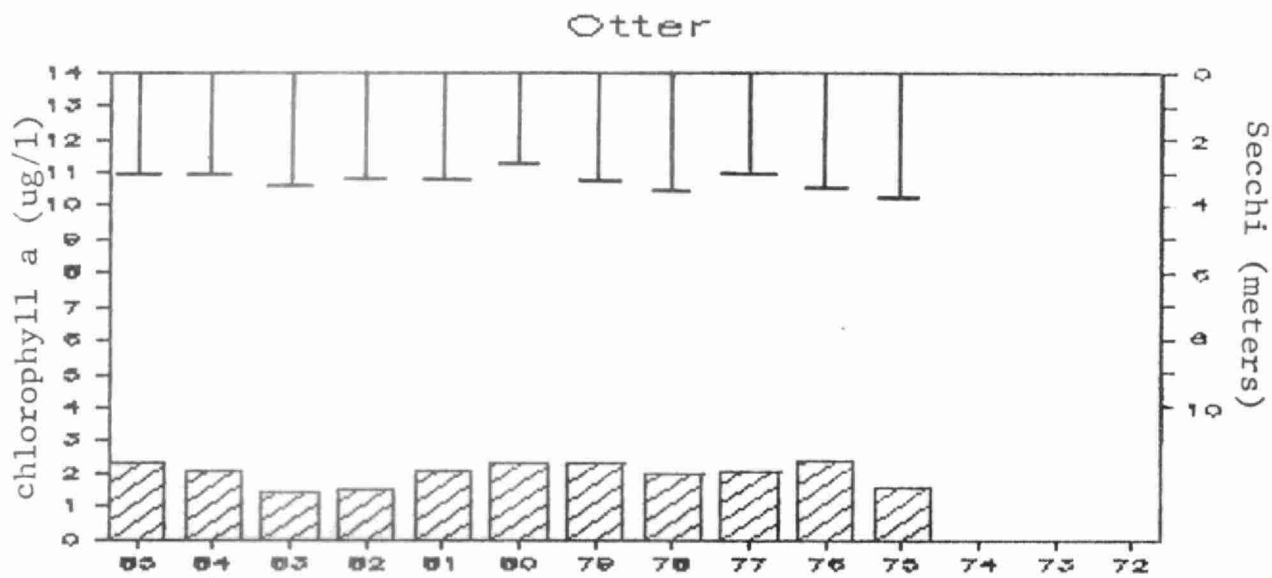

Mosque (west basin)
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

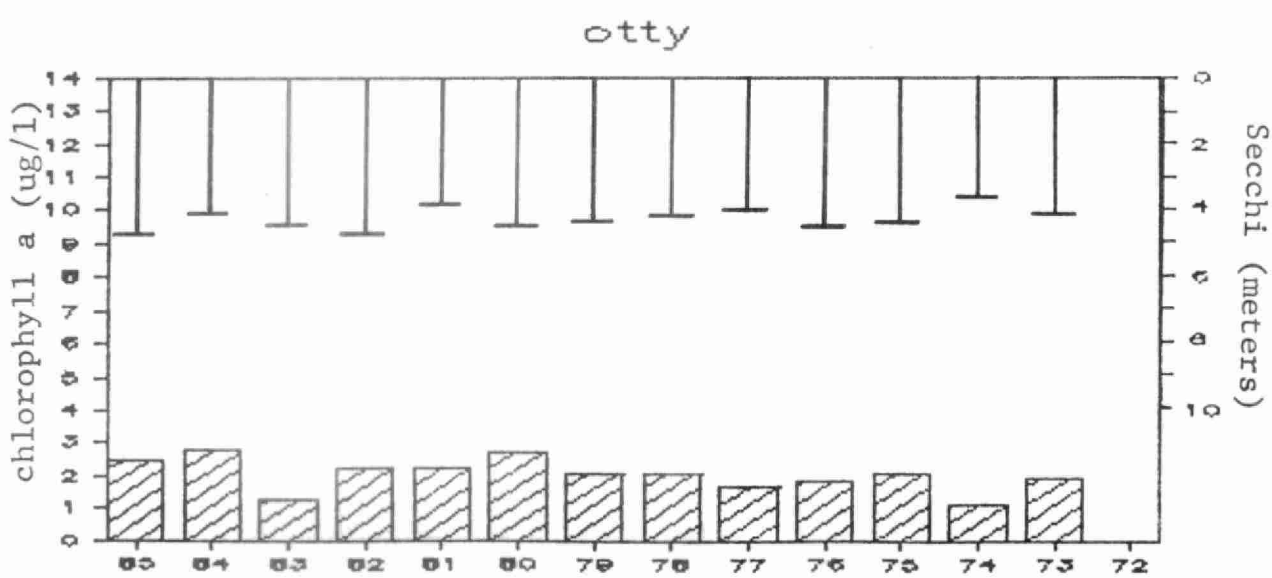

Muskrat
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

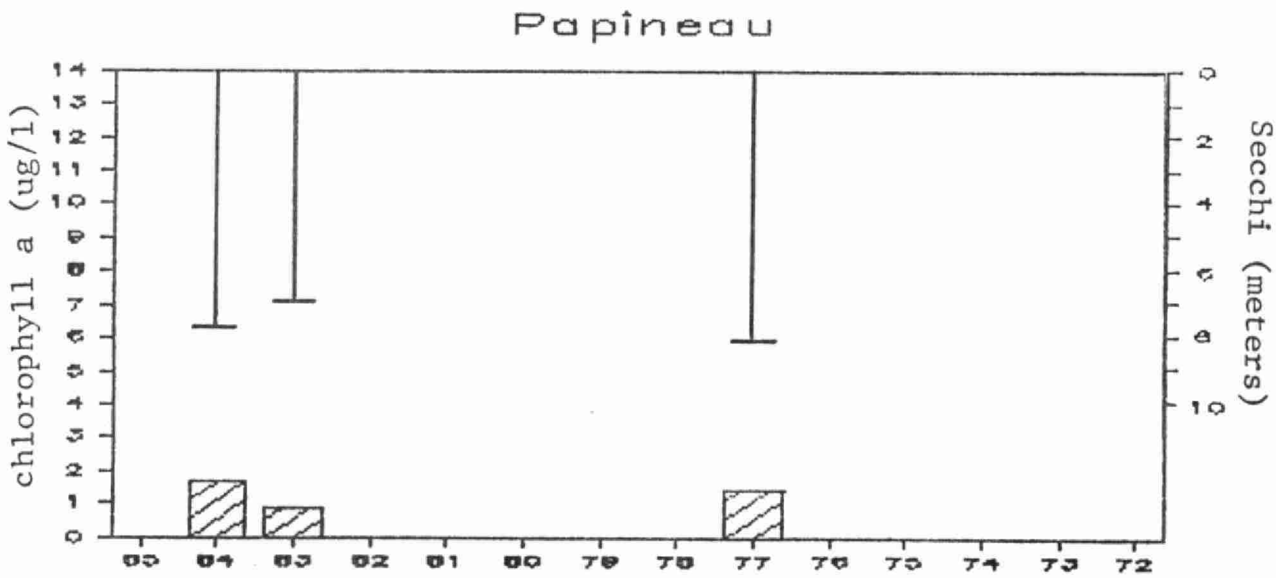

Norway
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

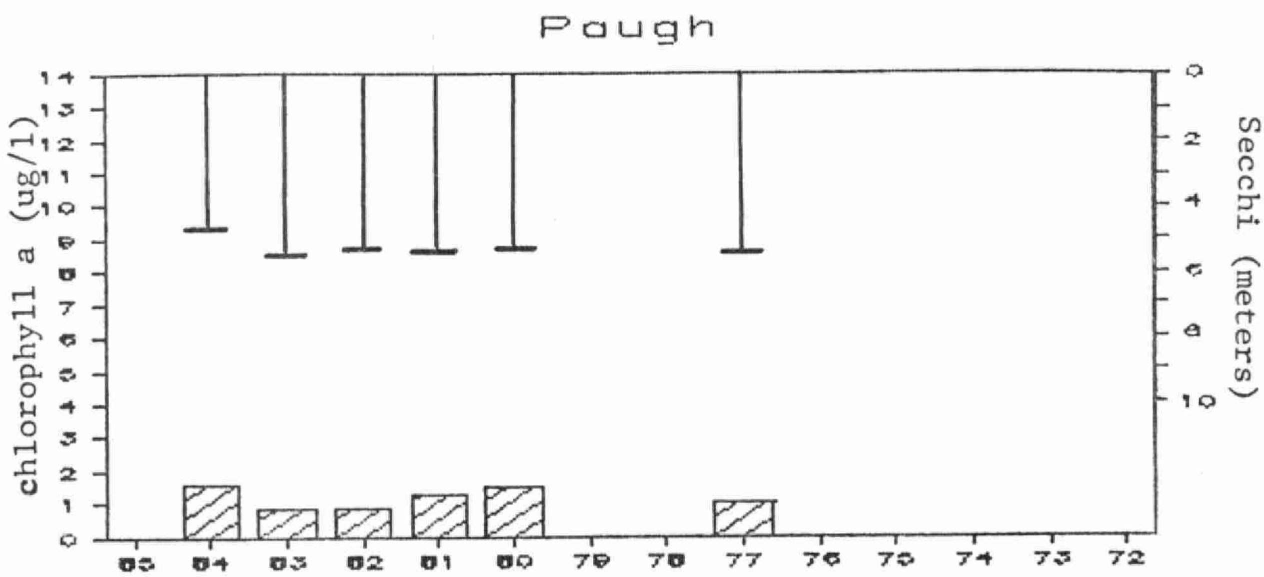

olmstead
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

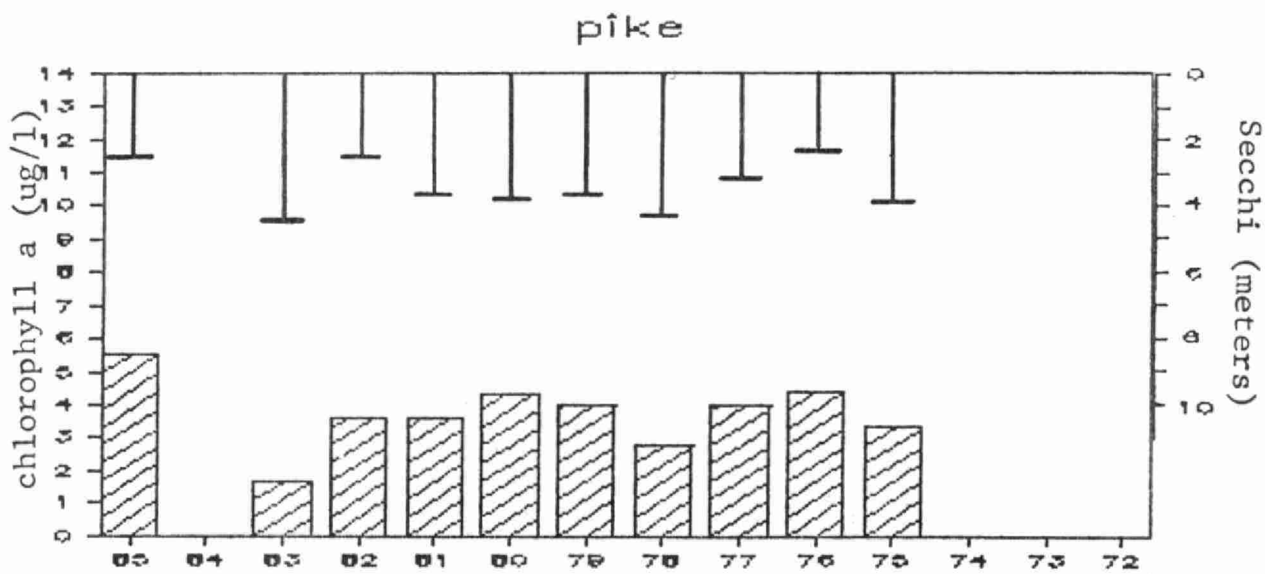

opinicon
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

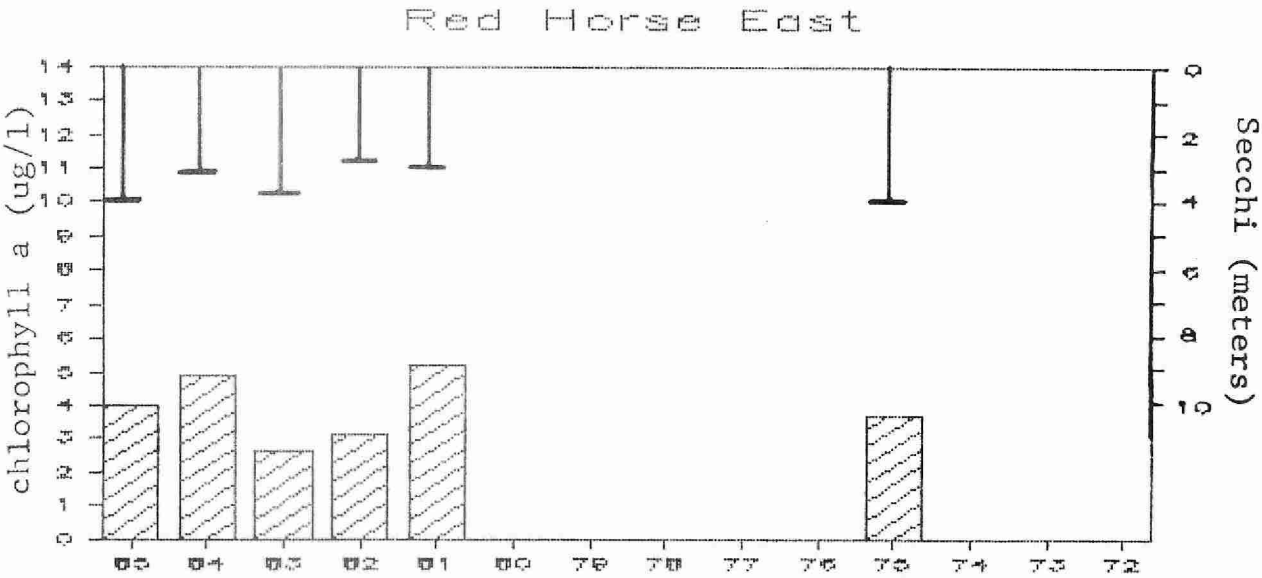

Otter
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

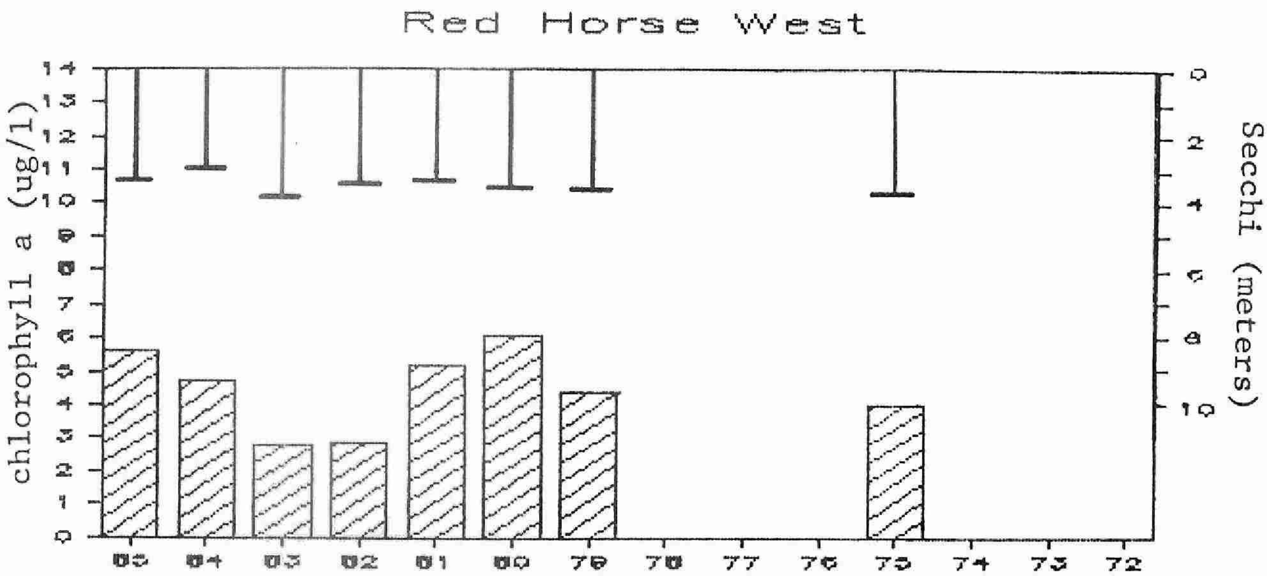

otty
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

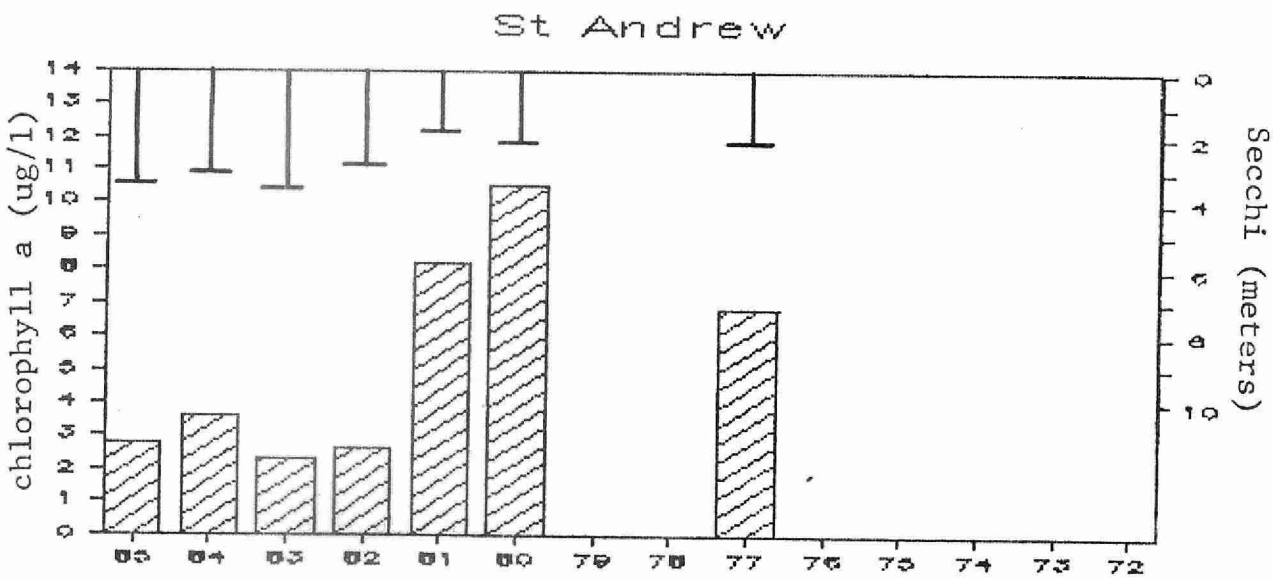

Papineau
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72


Paugh
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72

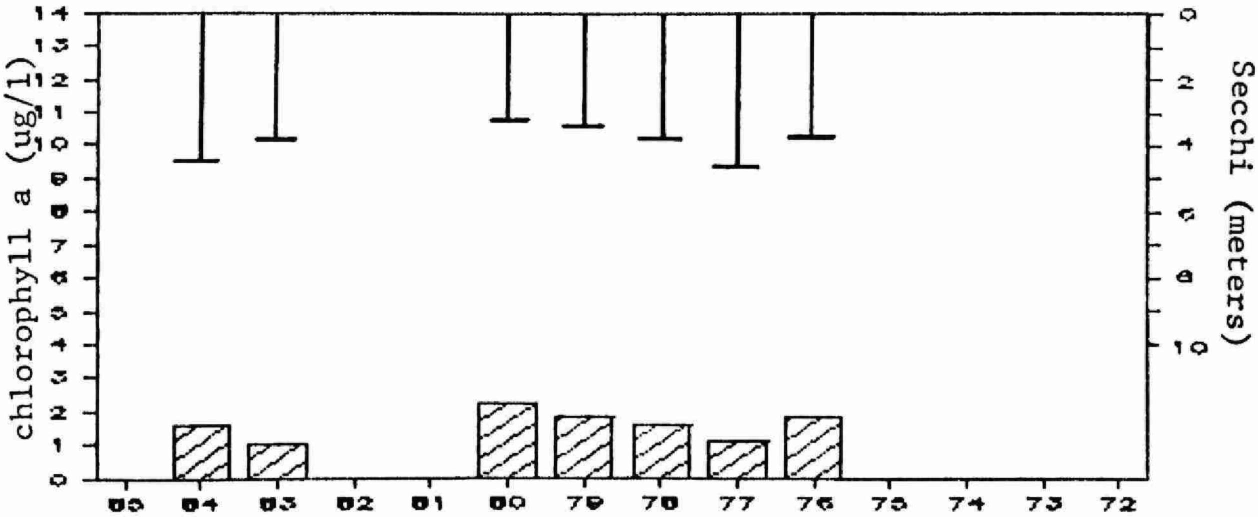

pike
chlorophyll a (ug/l)
Secchi (meters)
85 84 83 82 81 80 79 78 77 76 75 74 73 72


Red Horse East
chlorophyll a (ug/l)
Secchi (meters)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72

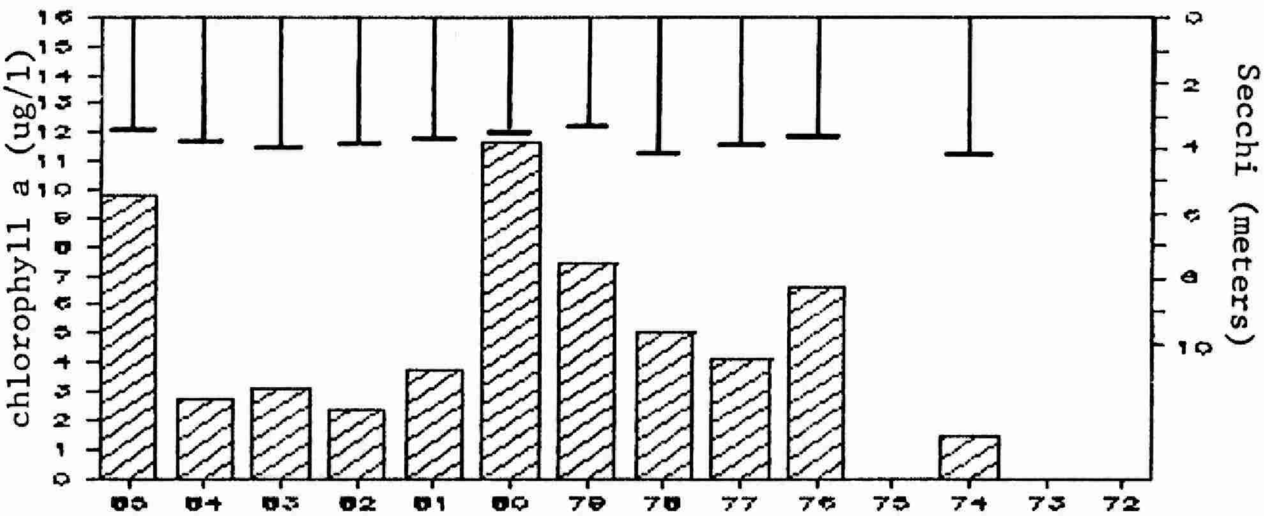

Red Horse West
chlorophyll a (ug/l)
Secchi (meters)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72


St Andrew
chlorophyll a (ug/l)
Secchi (meters)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72

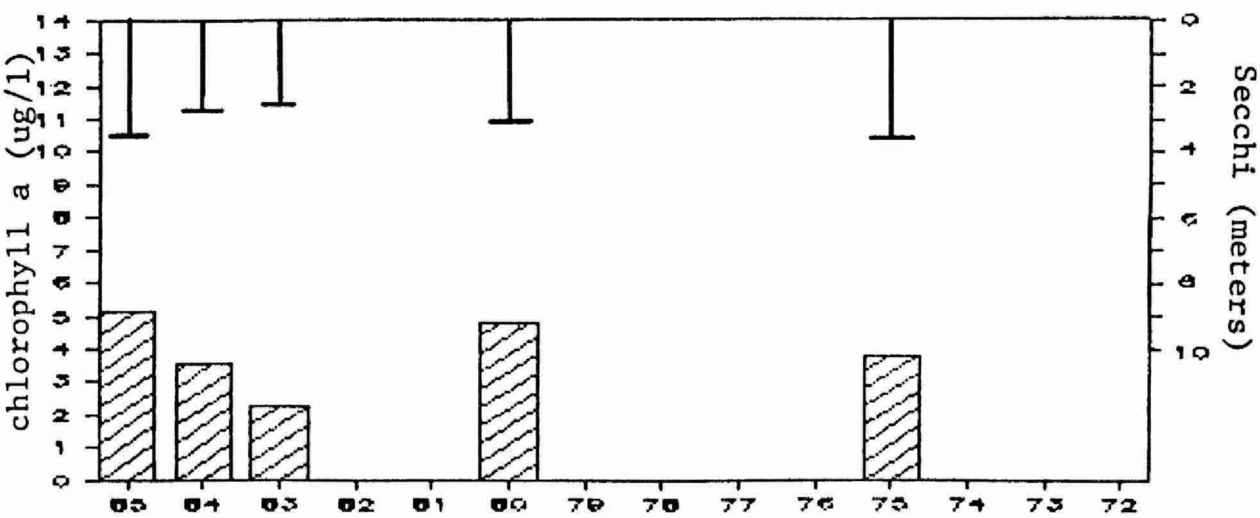
St Peter

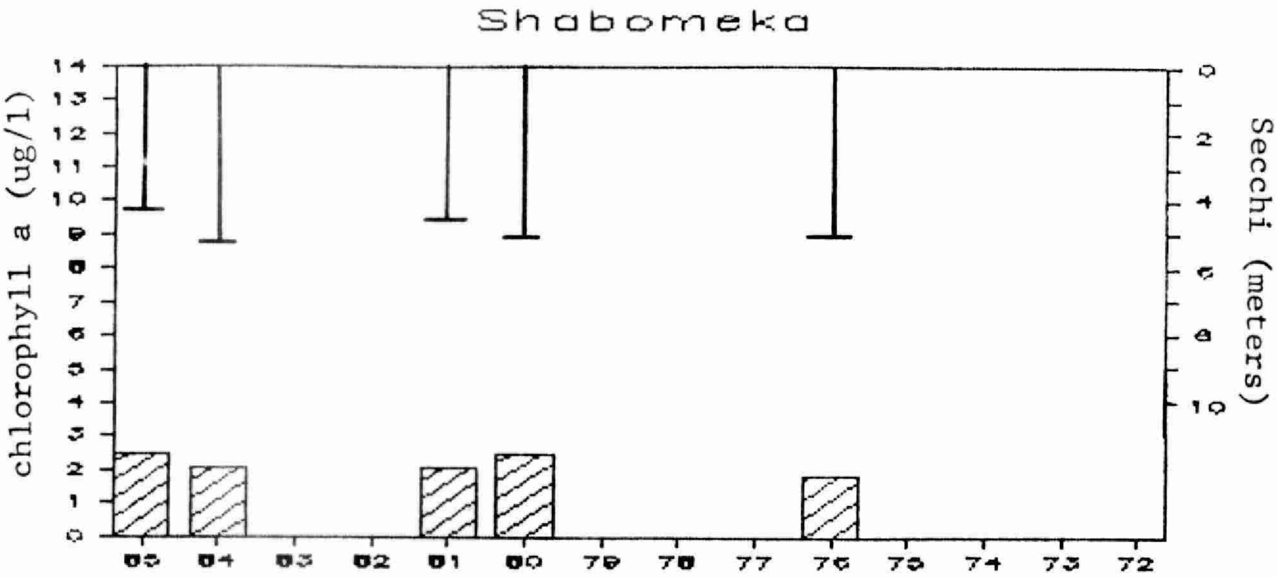


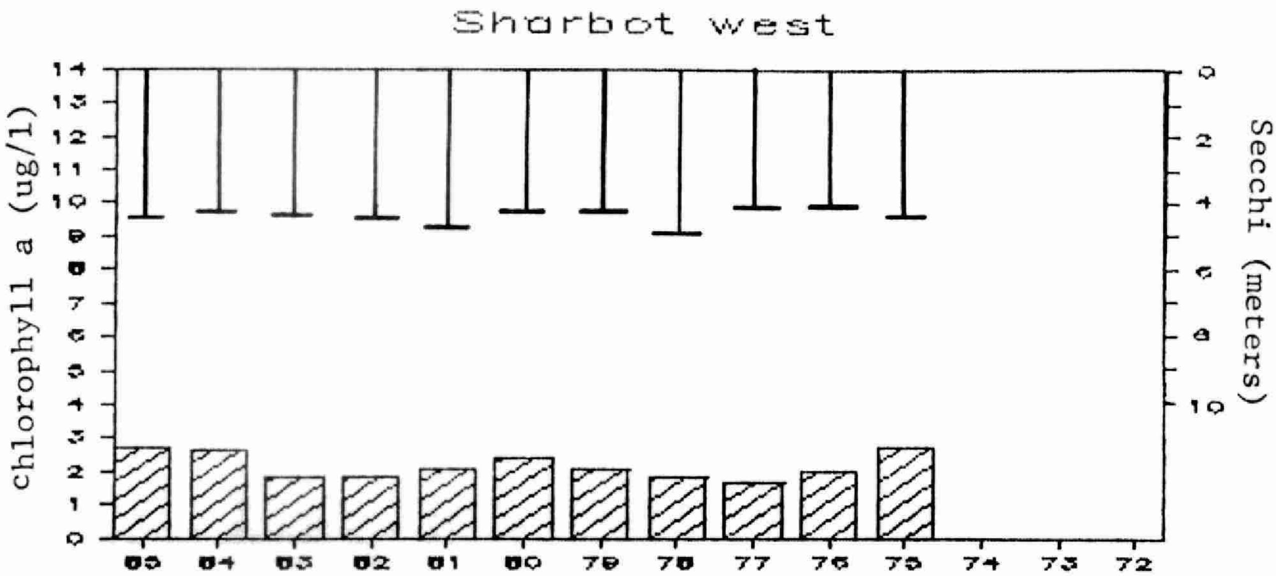
Salmon Trout

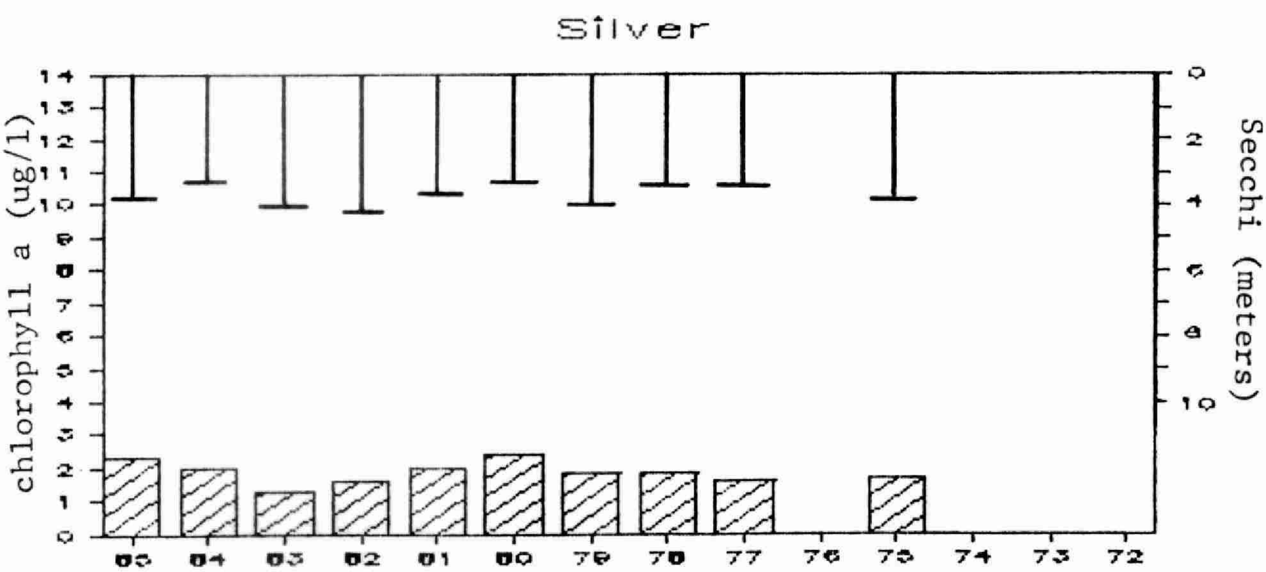


Sand

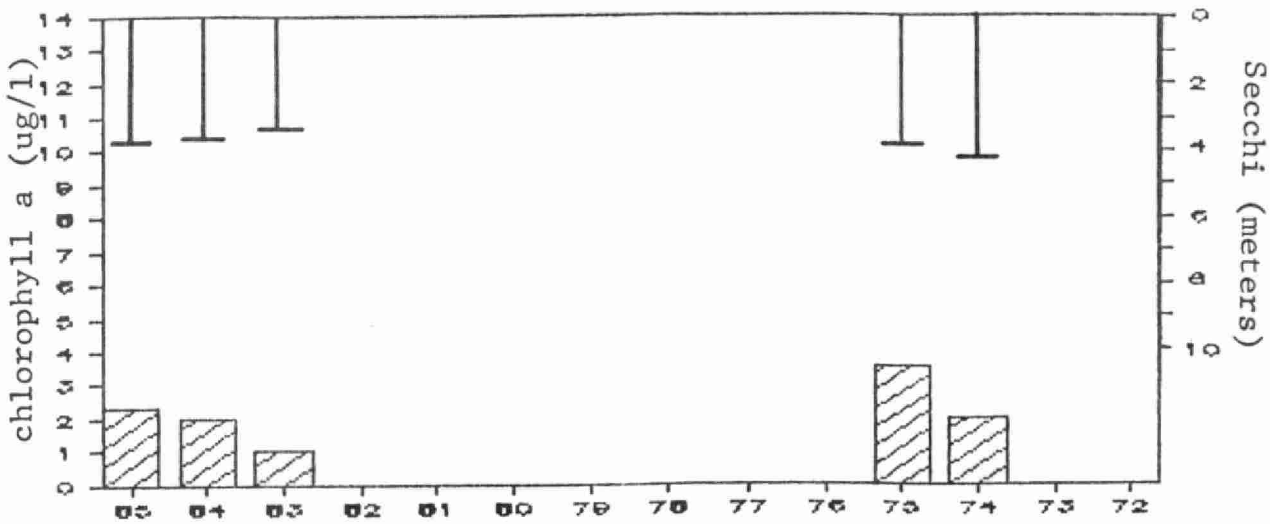



Shabomeka
chlorophyll a (ug/l)
Secchi (meters)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72

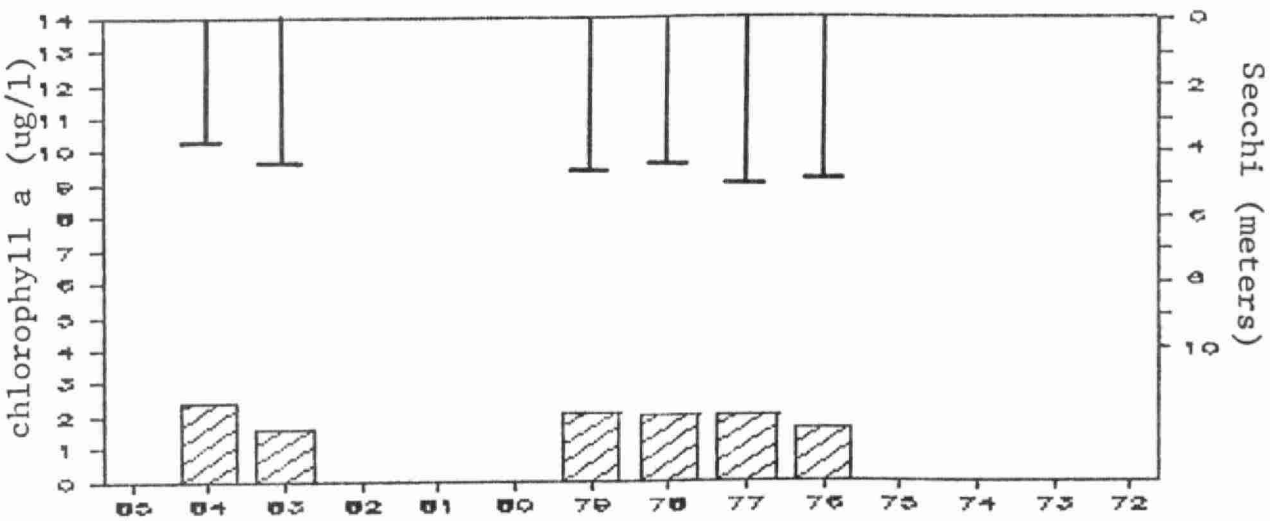

Sharbot west
chlorophyll a (ug/l)
Secchi (meters)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72


Silver
chlorophyll a (ug/l)
Secchi (meters)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
0 2 4 6 8 10
85 84 83 82 81 80 79 78 77 76 75 74 73 72

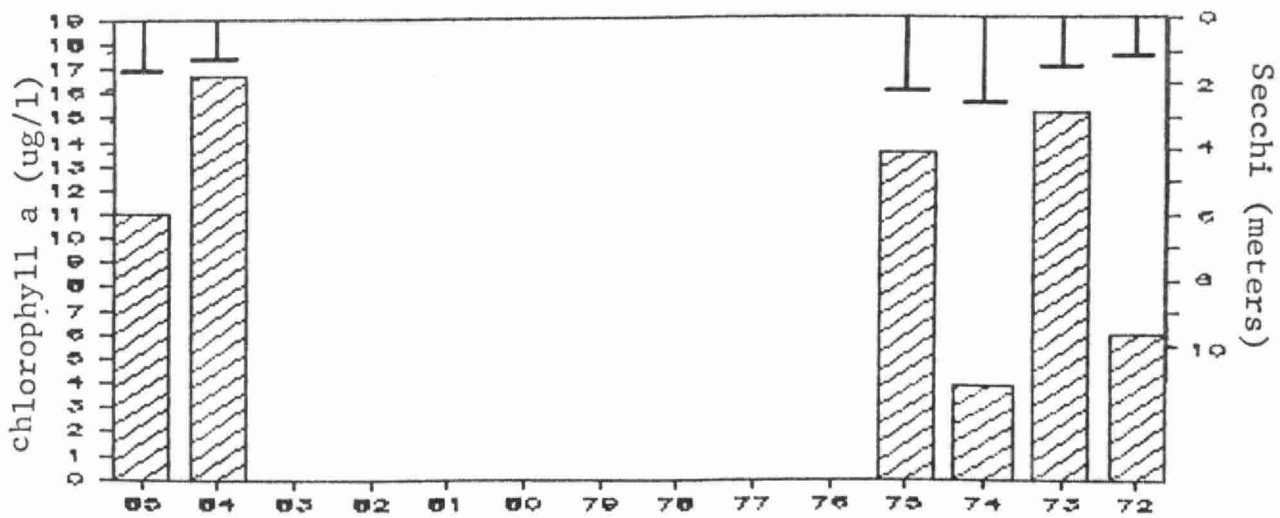
Skootamatta — Upper Lake West Basin



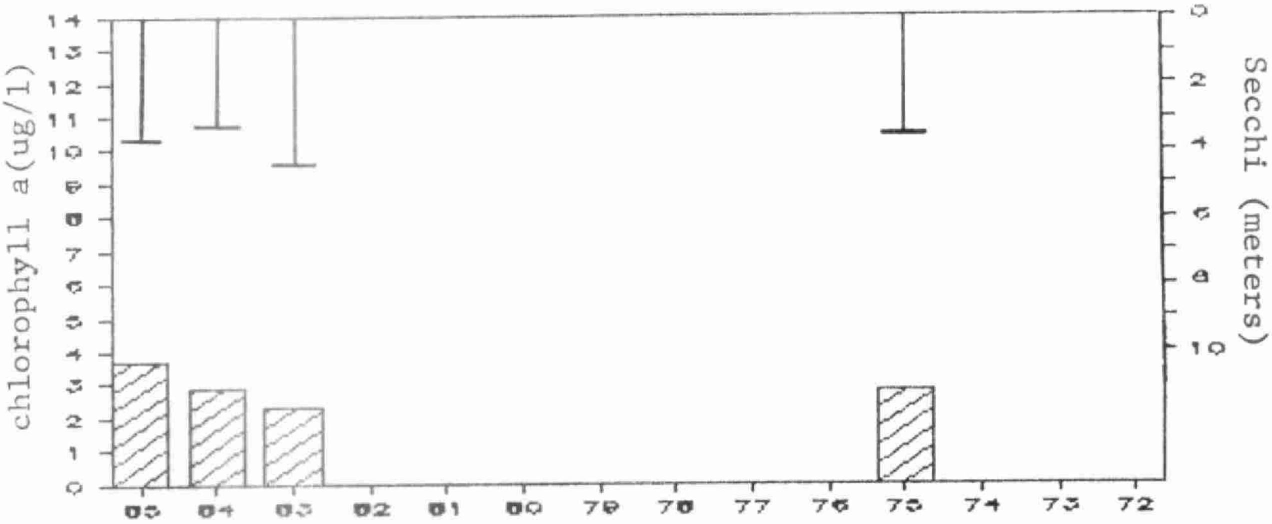
Steenburg



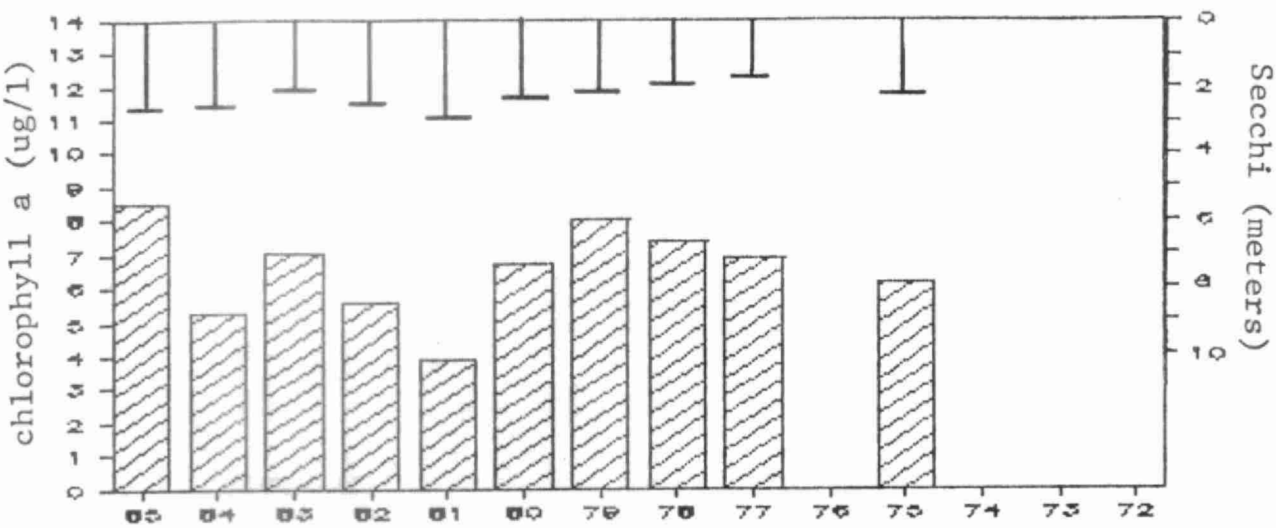
Stoco



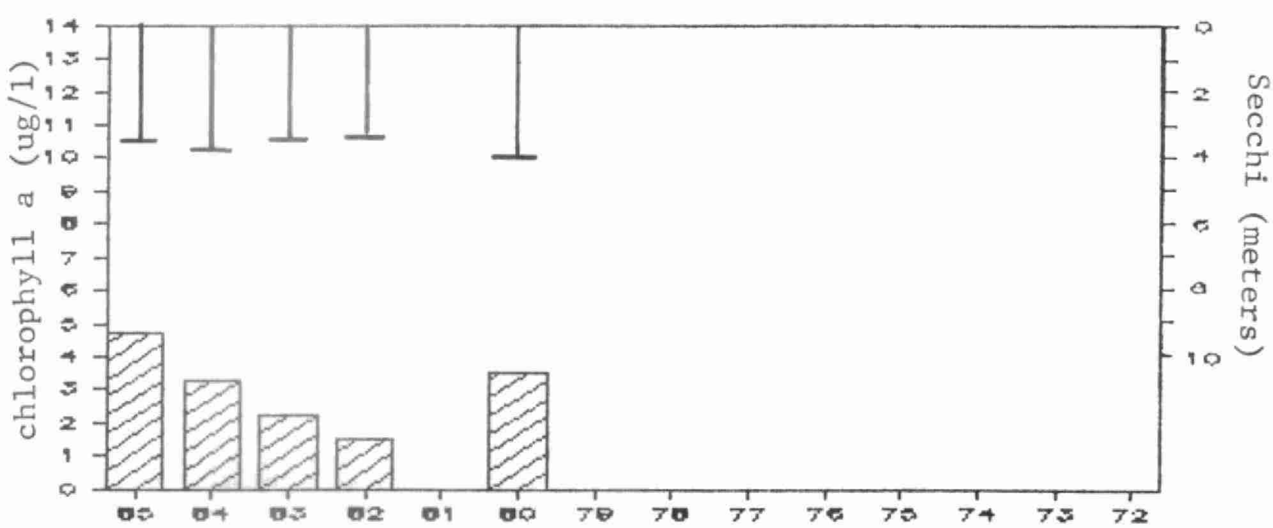
13 Island



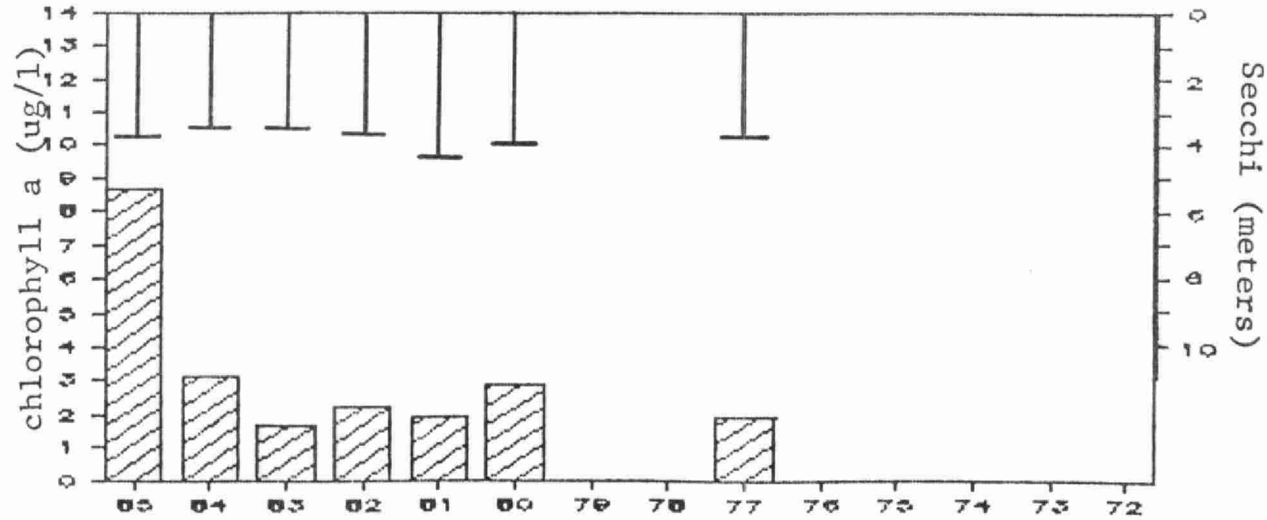
Troy



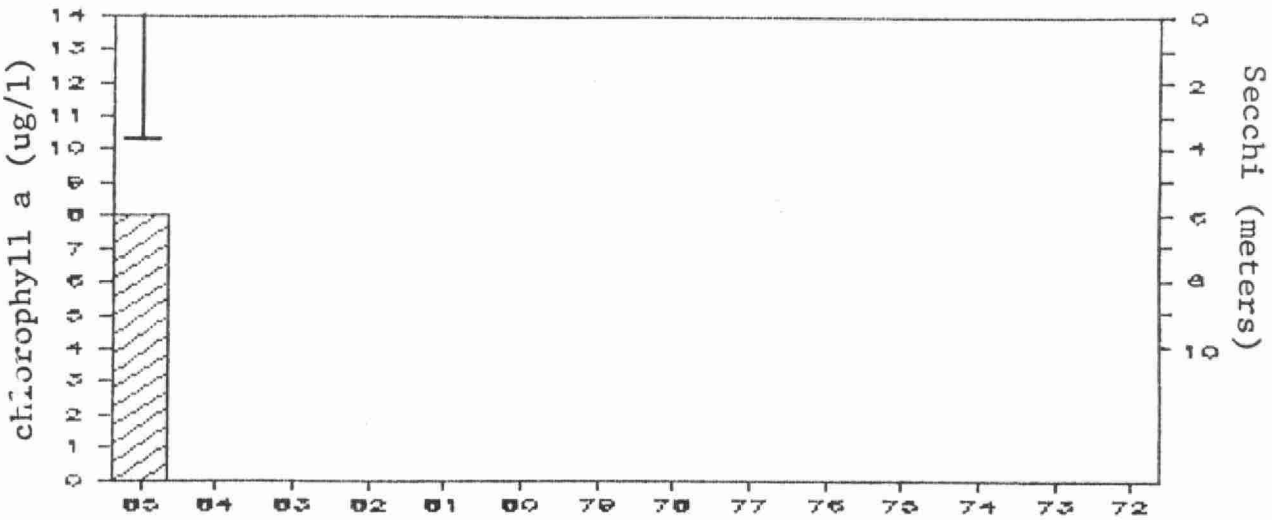
Twin Sister east



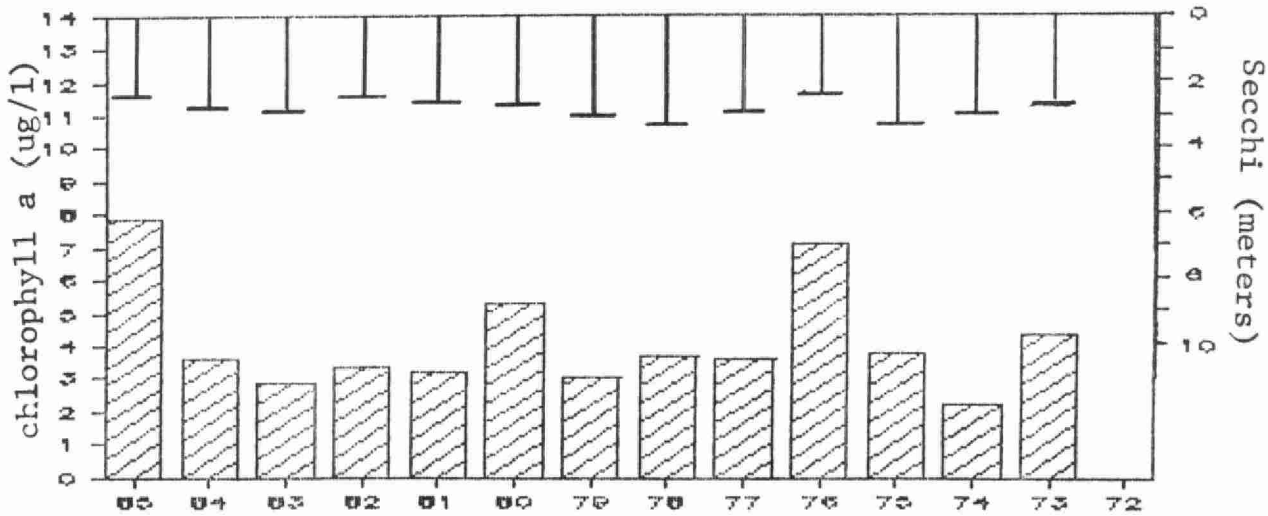
Twin Sister West



west



White



TERMINAL STREAM: TWELVE MILE CR.

DATE	ISSUED TO